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CIVIL ENGINEERING

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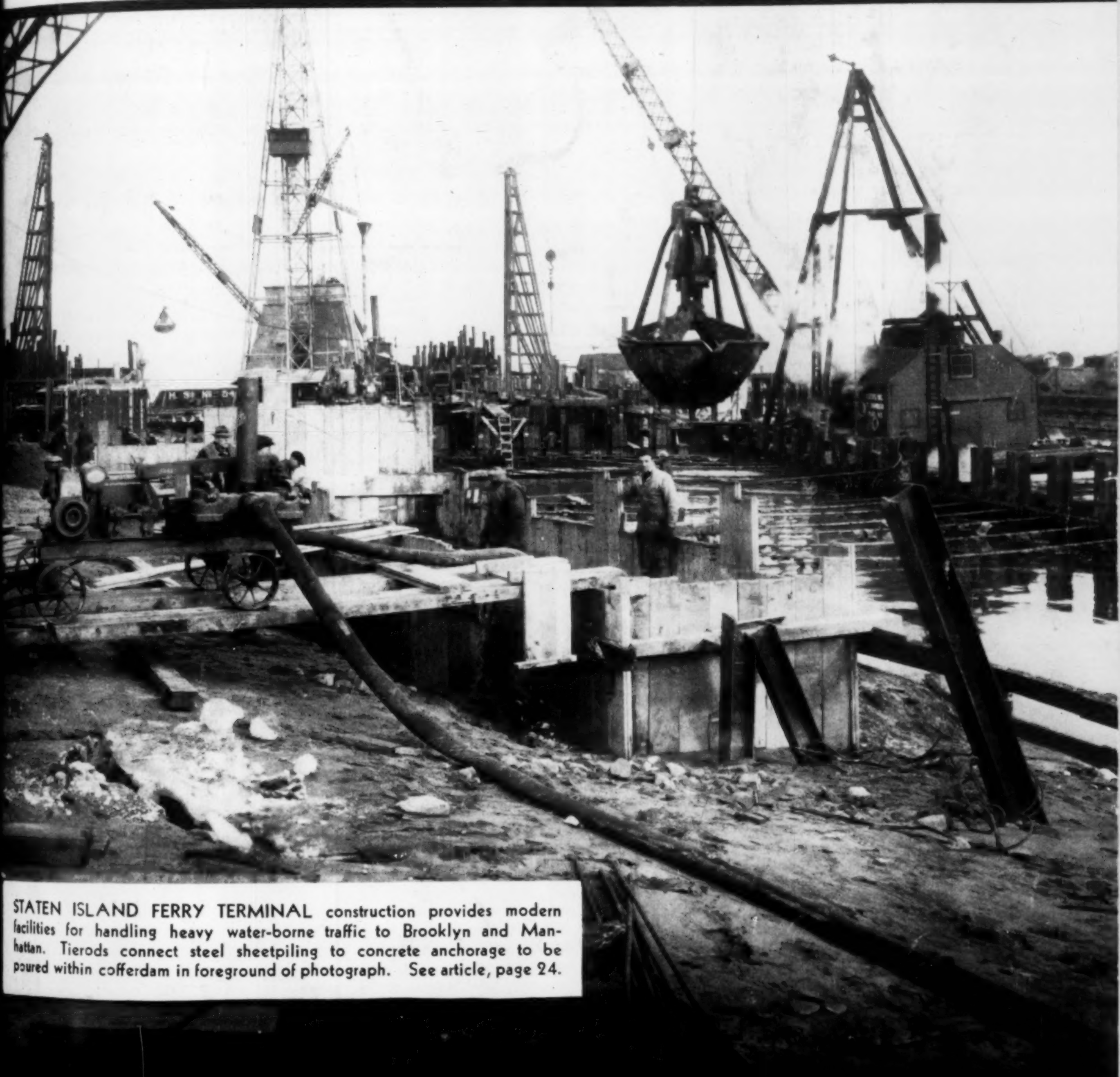


STATEN ISLAND FERRY TERMINAL construction provides modern facilities for handling heavy water-borne traffic to Brooklyn and Manhattan. Tierods connect steel sheetpiling to concrete anchorage to be poured within cofferdam in foreground of photograph. See article, page 24.

rted [illegible] ver—May

[illegible] of Planning a Union Bus Terminal—Bahn

ospital Construction for Leper Colony Presents Engineering Problems—Greenleaf

Social Order Influences Methods Used to Exploit India's Water Resources—Straub

FALL MEETING DIVISION REPORTS—Page 17

ANOTHER RAYMOND JOB FOR GULF OIL

AT PORT ARTHUR, TEXAS—Raymond is widening a marginal wharf more than half a mile long by constructing another wharf 25 feet wide along its face. This project is at the marine terminal of the Gulf Refining Company where Raymond built the first section of the existing wharf in 1911.

Today's job of constructing the 2900-foot wharf calls for the following: Concrete deck totalling 142,500 sq. ft. —requiring 4600 cu. yds. of concrete. 677 vertical piles averaging 68 ft. in length. 254 batter piles averaging 73 ft. Resurfacing 70,000 sq. ft. of existing deck. Fender system and mooring bollards along the new face.

Work progressed in 500-foot sections while docking operations continued along the rest of the wharf. This large and complex project demonstrates Raymond's ability to meet special requirements of the client.

THE SCOPE OF RAYMOND'S ACTIVITIES—*includes every recognized type of pile foundation—concrete, composite, precast, steel, pipe and wood. Also caissons, underpinning, construction involving shore protection, shipbuilding facilities, harbor and river improvements, borings for soil investigation.*

RAYMOND

51 YEARS FOUNDED IN 1897 OF PROGRESS

CONCRETE PILE COMPANY

Branch Offices in Principal Cities
of United States and Latin America

140 CEDAR STREET • NEW YORK 6, N. Y.

Boston Expressway Plan Captures Technical Interest at ASCE Fall Meeting

MITED-ACCESS HIGHWAYS relieve the serious congestion in the ston area, in keeping with a $322- llion Master Plan, held the atten- n of the joint session of the City nning and Highway Divisions at Boston Fall Meeting, which in- ded two days of technical pro- ams. The Highway and City nning session was held on Wednesday afternoon, October 13. Also included in the technical program on Wednesday afternoon were separate sessions of the Power and Construction Divisions.

Technical Division programs on Thursday included those of the Soil Mechanics and Foundations Division, which held morning and afternoon sessions. The latter was devoted to reports from the Second International Conference on Soil Mechanics and Foundation Engineering held in Rotterdam in June of this year. Four Divisions held single sessions on Thursday—Air Transport, Sanitary Engineering, Structural, and Surveying and Mapping. Subjects treated at these sessions are reported in the following write-ups.

Landing-Field Engineering Techniques Keep Pace with Advances in Aviation

OW ENGINEERS are revising nding-field drainage systems to keep ce with aviation's technological ad- nces which have reduced non- able weather was described at the ssion of the Air Transport Division. erett C. Crites, Washington, D.C., ember of the Division's Executive mmittee, presided. Papers pre- nted were: "Model Studies on Air- ld Drainage Structures," by Mar- E. Nelson and Harvey J. Johnson, rps of Engineers, St. Paul, Minn.; utter-Type Drainage Systems in ow Areas," by W. E. Cullinan, Jr., perintendent, Airports Branch, vil Aeronautics Administration, w York; and "Deficiencies of Air- ld Drainage," by Harold A. ott and Frederick J. Rawstrom, th the Corps of Engineers at cksonville, Fla., and Savannah, Ga., spectively.

W. E. Cullinan, Jr.

"With the great reduction in the ount of non-flyable weather, due technological improvements in en ute and landing navigation aids, premise on which many landing- ld drainage systems were built, mely, that the field would be closed ring and for two hours after a rm, is now unsound," Mr. Cullinan d.

Pointing out that stone-filled and ulevard section drains utilized tensively on landing fields in the st have been particularly unsatis- ctory in cold climates, Mr. Cullinan d that snows, melting in mid- nter thaws and then refreezing, ve resulted in loss of utility of ains and have brought about closing wn of some fields for as long as ten ys.

He described the gutter-type drains as "a system for the collection of surface water through inlets within the paved area itself," in contrast with the earlier drainage systems installed outside the paved area of landing fields. Citing expressions of satisfaction from airport managers in the northeastern United States with the improved drainage provided in snow country by the gutter-type system, Mr. Cullinan said:

"Many of those who acknowledge the advantage and desirability of the gutter system are concerned over the higher cost. A comparison of the cost of the stone-filled marginal drain with the gutter type shows this increase to be less than $2,400 per 1,000 ft of runway. The cost of the complete landing strip will vary, on the average, between $60,000 and $100,000 per 1,000 lin ft, of which approximately $40,000 represents runway paving. The added cost, therefore, amounts to approximately 6 percent of the cost of paving, of from 2.5 to 4 percent of the whole landing strip."

Martin E. Nelson and Harvey J. Johnson

"The design of drainage systems for airfields has been based largely on information obtained from analogous surface drainage systems for streets and roads," Messrs. Nelson and Johnson asserted in their paper. "The types of channels and inlets which are satisfactory in urban areas and on highways are not usually acceptable under the severe traffic conditions imposed on military airfield runways and landing strips. Recognizing the need for design data specifically applicable to the shallow gutters and flush inlets which must be used on runways of major airports, the Office of the Chief of Engineers, Department of the Army, in May 1946 authorized a laboratory study to be made on a model of a typical installation. The study was made in the Hydraulic Laboratory of the Iowa Institute of Hydraulic Research at the University of Iowa by members of the St. Paul District Sub-Office of the Corps of Engineers.

"This investigation was instituted for the purpose of determining (*a*) the discharge capacity of a typical concrete runway gutter, (*b*) the discharge capacity and hydraulic characteristics of several types of commercial cast-iron and structural steel inlet grates, and (*c*) the discharge capacity of curb inlets. Specifically it was desired to obtain such data as would enable the designing engineer to determine the spacing of drainage inlets required to remove effectively and economically the water collected in a runway gutter of given slope during a rainfall of a given intensity.

A portion of runway pavement and gutter was constructed to a scale of 1 to 2. The model pavement, about 21 ft wide and 67 ft long, with a transverse slope of 1.5 percent, was revised five times to simulate as many different longitudinal grades. A 1-on-16 back-slope 4 ft wide formed a gutter invert along the edge of the pavement. The model with a longitudinal grade of 0.25 percent was constructed and tested first and subsequently reconstructed with grades of 0.75, 1.0, 1.5, and 2.0 percent. The concrete surface was finished with a trowel. After the 1-to-2 scale tests on 1.0 and 2.0 percent grades were completed, a broomed mortar finish similar to the belted concrete finish used on full-scale runways was applied to the pavement and gutter surfaces in order to evaluate friction factors for prototype installations."

Using slides and charts, Messrs. Nelson and Johnson depicted various results obtained in the model studies.

Cost Controls Are Called Essential in Modern Competitive Bidding Construction

CONSTRUCTION COST CONTROLS, expertly wielded by government and private builders to reflect continuously the actual job conditions on each project, were advocated before the Construction Division session, at which Elmer K. Timby, Princeton, N. J., member of the Division's Executive Committee, presided.

Papers were presented by H. P. Maxton, Secretary–Assistant Treasurer, Raymond Concrete Pile Co., New York, on "Cost Control in the Construction Industry"; R. H. Heitman, Chief Engineer, Western Contracting Co., Sioux City, Iowa, on "Engineering in Construction Cost Control"; and Kenneth W. Markwell, Assistant Commissioner, Bureau of Reclamation, Washington, D.C., on "Cost Control Problems on Reclamation Projects."

H. P. Maxton

Mr. Maxton, who is chairman of the Construction Division Committee on Basic Accounting Procedure, gave his listeners a preview of a manual under preparation by his committee and, in stressing the needs for cost controls, asserted:

"No business can long survive without a knowledge of costs and without an intelligent control of costs. This is no less essential to the survival of contractors than of any other business. Sometimes adverse weather and flood conditions contribute to contractors' losses, especially on heavy construction operations, but perhaps the most common form of loss is just plain inefficiency of management and supervision."

Emphasizing that, except to correct errors and cut costs on future work, "it will do little good to analyze cost and hold postmortems when the job is complete," Mr. Maxton pointed out the need for the establishment of cost analysis and cost studies "as quickly as possible when the job gets going."

R. H. Heitman

In his paper, Mr. Heitman asserted:

"Some contractors may have the theory that the construction man on the project should not know what the work is costing but should just do the work as best he can. This school of thought has no place in modern competitive bidding contracting and should have gone out along with the old construction 'stiff' who couldn't read or write and moved dirt with mules and wagons. Cost reports prepared from the cost accounting system every week or two enable construction men to catch immediately any item which is running off and to take corrective measures before it is too late.

"In order to bid his work, a contractor must know what previous projects have cost him, and the co must be in such form that he c apply and correct the figures to ta care of new and changing conditio on the work on which he is biddin The necessity for this, especially these times of inflation, is great than ever."

Kenneth W. Markwell

In his paper, Mr. Markwell said:

"There must be a means whereb engineers and accountants can spe the same language. We must provi a common basis for the developme of a project from the pre-authorizati stage to final completion and ope tion. In the Bureau of Reclamati we must know the status of our fun in relation to our obligations so th we will not over-obligate funds in t current fiscal year and thereby inc a deficiency. Contractors need co controls for the protection of th solvencies and profit, but we ne them for the protection of the inve ment of the public in these gre projects. I consider cost controls be an indispensable tool of manag ment in directing, controlling and porting the work of the Bureau fro the initial investigation throu authorization and construction, a through operation until a project paid for."

He described a new system inaug rated by the Bureau which, he sa would ease the work of both acco tants and cost engineers and is e mated to "save the Bureau abo $250,000 a year in salaries of accou ing personnel alone."

Man's Habits, Events and Weather Guide Power Firms in Estimating Loads

HOW THE HABITS of man and special events and weather provide a pattern for power companies in estimating load requirements was detailed in one of three papers presented at the Power Division session. Arthur T. Larned, New York, chairman of the Executive Committee of the Division, presided. Papers presented were: "Berlin, New Hampshire, Hydroelectric Development," by H. D. Resseguie, Construction Engineer, and W. C. Tallman, Technical Assistant, Public Service Co. of New Hampshire, Manchester, N.H.; "Water Power Storage in Maine," by Howard M. Turner, Boston consulting engineer and Professor of the Practice of Civil Engineering, Harvard University; and "New England Interconnections and System Operation," by Clement P. Corey, Chief System Dispatcher, New England Power Co., Millbury, Mass.

C. P. Corey

Man is such a creature of habit that, in most instances, his electricity requirements can be forecast within 1 percent, Mr. Corey asserted in the last-named paper. Discussing New England interconnections of companies producing more than 12 billion kilowatts annually and having an hourly demand in excess of 2 million kilowatts, Mr. Corey said:

"Habit may vary somewhat in different areas, but tends to become fixed in a given locality. In time these local habits come to be talked of as 'the normal routine,' 'lunch time,' 'bed time,' or 'time to get up.'

In dealing with large numbers people it is safe to assume that m of their acts on any given week will duplicate their acts on the pre ous weekday. This fact establishe pattern of electrical demand a renders reasonable assurance that electrical appliances in existence w not be turned on simultaneously— circumstance that would call for t mendous plant investment.

"A further assurance is given the reluctance of a population change its living habits sudden Changes in habits will be reflected the load and give warning to utility man who watches for s trends.

"Events affect the load, but th effect—barring war or major ca trophe—is generally of short du tion. Holidays are an exception this statement, of course, for here event is effective throughout ye this exception is so well establis ter a few years, however, that it lls into the category of habit. The fect of most events is to increase the ad for a short time, usually in the ening. Events of this type include orts events, elections, important blic addresses, etc., and call for crease in lighting and radio load.

"Weather affects the demand by anging the requirements for lightg, heating, or air conditioning. ss common, but occasionally met ith, are instances where storms keep orkers from their employment with consequent decrease in demand. The effect of weather is subject to a reasonable analytical appraisal. Some approximate statistics for a load embracing urban and rural elements would be:

"A very dark weekday may cause an increase of about 6 percent in total demand over that experienced on a bright day.

"In the winter, using the load observed at 45 deg F on a calm day as a base, an increase of about 0.15 percent per degree drop may be experienced between 7.00 a.m. and 11.00 p.m. Extreme wind conditions may add as much as an additional 1.5 percent to this increase. Increase in use of house insulation may shade this figure in the future.

"In the summer, using a humid weekday with an average temperature of 80 deg F as a base, an increase of about 0.20 percent per deg F rise may be experienced in the 80–95 deg range during the 7.00 a.m. to 5.00 p.m. period on weekdays. Temperatures of 95 deg F and above may bring about a decrease in load due to curtailment of operations because of heat."

Boston's Master Highway Scheme Is Hailed as Milestone in Effective Planning

OSTON'S PROPOSED $322 million Master Highway Plan was used a model in a clinical analysis of affic congestion at a joint session of e City Planning and Highway Disions. Frank H. Malley, Provience, R.I., chairman of the City anning Division's Executive Comittee, presided. Four papers essed the need for express highways at will "bring into physical balance e opposing forces of decentralizaon of cities through flight of resints to the suburbs and concentraon of readily accessible business terprises in the cities' centers."

William H. Buracker

Admiral William H. Buracker, assachusetts Commissioner of Pub Works, told of the engineering proach that had been used in concting an origin and destination rvey encompassing 23 cities and wns in addition to Boston. He scribed the resulting plan as taking e form of eight radial routes procting in as many directions from a rcumferential or belt highway ound the city, with a total system ngth of some 87 miles.

"The expressways as proposed," ommissioner Buracker said, "will be limited-access type providing for ift uninterrupted flow of all types traffic and with no entering or cross eets except at prescribed points of terchange where grades will be parated. Indications are that the pressways by 1970 will be carrying lumes varying from 33,000 to ,000 vehicles per day.

"A program of stage construction, sed upon priority of need and inditing costs by construction periods, included in the report covering the oject. In attempting to produce a financing program for the metropolitan plan, the needs of the remainder of the state must be kept in mind, and a fair balance maintained in order that an equitable expenditure of highway funds may result. Current gasoline tax incomes will undoubtedly prove inadequate to provide for underwriting the program on a pay-as-you-go basis. On the other hand, attempting to scale construction progress down to meet the tempo of normal highway-fund income would prolong completion of the plan too far into the future. Means should be found that will provide for an accelerated 10-year construction program and at the same time keep gasoline tax levies within reasonable bounds." He pointed out that an immediate study leading toward recommendation of a specific system of tolls to help finance the project has been recommended.

Theodore T. McCrosky

Theodore T. McCrosky, M. ASCE, Consulting Engineer, Executive Director, Greater Boston Development Committee, Inc., told of the support given the master highway plan by his organization "because, in the Boston region, free flow of traffic is so conspicuously the exceptional condition, and congestion the rule."

Breaking down the major conflicts involved in urban traffic to "a conflict between vehicles using the same streets but having fundamentally different destinations, conflicts between different types of traffic, and the fact that every city street is potentially used for the conflicting purposes of moving traffic, pickup and delivery of goods and passengers, and dead parking of vehicles," Mr. McCrosky said:

"What is needed is fluidity of movement, realizable by a network of expressways that will take the traffic near to all the places where it wants to go. With this fluidity achieved, principal business districts again will flourish, and outlying residential areas will be brought closer in time to the town centers."

Boston's downtown center, he said, despite "an excellent rapid transit system, has lost about half of its assessed real estate value in less than 20 years."

Calling the fact that the press and general public "are at last fully aware that the building of a planned network of expressways is a matter of economic necessity," a matter of the "greatest significance," Mr. McCrosky said of this awareness:

"It is the surgical operation that will save the life of the greater Boston community. Those who hold public office now know that express highways must be built; that palliative remedies can no longer carry the malignant disease of traffic congestion; and that the people of this commonwealth will not brook any further delay."

Fred J. Hughes

Fred J. Hughes, Planning and Program Engineer, Public Roads Administration, Albany, N.Y., presented an integrated parking and expressway plan for downtown Boston, of which area he said, "small though it is, there are concentrated here some of the worst traffic headaches to be found anywhere. Here also exist some of the nation's fastest deteriorating real estate values—properties which have become outright slums; dilapidated buildings with vacant, unsightly upper floors, and century-old buildings that have long outlasted their usefulness but which are occupied by businesses that have no choice except to leave Boston."

Construction of a complete system of expressways and parking terminals "without requiring the withdrawal from business use or the tax rolls of a single square foot of land in the downtown district" was proposed in the plan offered by Mr. Hughes, who emphasized that under his scheme "by far the greater portion of the cost of the improvement shall be financed through the investment of private capital rather than the expenditure of public funds."

Questioning the "need or economic justification" for taking land for expressways alone when it has the business, financial and tax value land has in downtown Boston, Mr. Hughes proposed that double use be made of the land over which the expressways pass by the construction of buildings under and directly adjacent to elevated expressways, such as was done in connection with elevated roadways around Grand Central Terminal in New York.

Charles A. Blessing

The fourth speaker was Charles A. Blessing, Chief City Planner, Chicago Plan Commission, who said the Boston master highway plan follows clearly the pattern of centralization created by express routes of the early 1800's which tied together the economy of the region, helped to strengthen the dominance of the central city, and played a significant part in "ushering in the golden age of the Port of Boston during the 1840's and 50's." Illustrating his point that Boston's traffic problems are not new Mr. Blessing said:

"So great was the wagon traffic in downtown Boston as early as 1820, that after a certain hour in the evening wagons were prohibited from entering over the neck of land which at that time tied Boston to the mainland. Washington Street was even then a congested traffic way."

Branding as "wasteful congestion" the manner in which "residence, industry, and commerce were thrown together" with the advent of the automobile, Mr. Blessing decried the fact that "as rural highways were improved with the aid of federal and state highway funds, more and more traffic entered the city and yet the nearer one approached the center, the less was done to provide adequately for the traffic."

Of the proposed Boston master plan for highways, Mr. Blessing said:

"It has been designed to serve the needs of the entire region. The construction of the proposed expressways will have a dominant influence in shaping the pattern of future growth of suburban areas and will provide a regional radial expressway system with a minimum of disruption to existing built-up suburban residential areas. The decisions reached by the highway planners in 1948 will influence the development of the suburban areas for many years to come and will open up extensive tracts of suburban land highly desirable for model, planned industrial developments." As a result of careful and continuing collaboration of highway experts with state, regional and local governmental officers and planners, the metropolitan Boston expressway system has been strategically located t achieve a maximum of efficient transportation service with a minimum o forces disruptive to community life It is truly a milestone in effectiv metropolitan planning."

Sound Pollution Abatement Policy Asked in Place of "Crazy Quilt" Pattern

A WARNING that stream pollution abatement "cannot be achieved by the simple expedient of the wholesale construction of treatment works," and a call to engineers to check the current "crazy quilt of pollution abatement policy" were sounded by Thomas R. Camp, Boston consulting engineer, in a paper presented before the Sanitary Engineering Division. The session was a joint one with the Boston Society of Civil Engineers and presided over in succession by Prof. Gordon M. Fair of the Harvard Graduate School of Engineering on behalf of the Division, and by A. L. Burdoin of Metcalf and Eddy on behalf of the Boston Society of Civil Engineers. The following papers also were presented:

"Pollution of the Androscoggin River by Industrial Wastes and Control Measures Thereof," by E. Sherman Chase, Boston; "Utilidors for Water, Sewer, and Other Underground Utilities in Arctic Climates," by William L. Hyland and Murray H. Mellish, Boston; and "The New Water Supply Tunnel of the Boston Metropolitan District Commission," by Karl R. Kennison, Chief Engineer, Construction Division, Boston Metropolitan District Commission.

Thomas R. Camp

In his paper, Mr. Camp declared:

"The current boom in pollution control activities has brought many people and groups into the field who are novices in sanitary engineering problems. We have at one extreme strong pressure groups interested in sports and wild life who appear to believe that pollution can be completely abated, and at the other extreme some manufacturers who are fighting to maintain the unhampered use of public water for the disposal of their wastes. The great diversity of interests represented by these newcomers and the lack of understanding on the part of many of them of the technical nature of the problems to be solved are producing a crazy quilt of pollution abatement policy. It behooves us to take stock of this situation now and to work for sane and sound policies throughout the nation. If we fail to develop economic, equitable and effective policies, the whole program may bog down through unwise and wasteful expenditures."

Likening the designation by pollution control agencies of appropriat uses of public water and the establishment of standards of water qualit suitable for such uses to zoning in th preparation of a city plan, Mr. Cam asserted:

"Once the standard of water quality is set, any degree of treatment o sewage or industrial wastes in exce of that required to meet the standa will result in economic waste. It i wrong to require more treatment tha is required to produce the desire results, and it is wrong to require an polluter to treat his wastes or sewag unless such treatment is required t produce the desired results at th least over-all cost. The problem o pollution abatement for a particul watercourse should be studied as whole so as to determine whic wastes must be treated and whic may be allowed to go untreated f the best economical solution.

"Water pollution control polici should be so developed as to perm the selection of wastes for treatmen and to permit the selection of wast which may be discharged untreat for best over-all economy. This contradictory to the policies whic have been followed by some agenci Under existing law it is easier for public agency to enforce a poli which requires treatment by all polluters on a given watercourse, and the same degree of treatment for similar wastes. This is an unreasonable policy, is uneconomical and is dangerous to the over-all program of pollution abatement.

"Except in cases where the agency is charged with the design and operation of the treatment process, the public agency should leave the details of design and operation to the polluter. Each polluter should be allocated by the control agency a definite quantity of polluting substances not to be exceeded at each point of pollution. The means by which the required degree of treatment is accomplished should be left to the ingenuity of the polluter. It is wrong to require standard methods of treatment if the polluter can show that he can produce the required quality of effluent by other means which he considers less expensive and more appropriate for his use."

E. Sherman Chase

A summary of conditions found and remedial measures adopted as a result of studies of the Androscoggin River was contained in Mr. Chase's paper. He noted the fact that "even Ripley, in 'Believe It or Not,' referred to the Androscoggin as a river whose fumes changed the color of painted buildings along its banks." This discoloration, Mr. Chase said, is the result of production of hydrogen sulfide in substantial quantities and "must tend to have a harmful effect upon the health of those living or working in the vicinity of the river, particularly at Lewiston, Auburn and Lisbon Falls. There is some specific evidence of ill health from this cause and the known toxic quality of hydrogen sulfide is presumptive evidence of the detrimental effect of river gases upon the public health of the communities referred to above under conditions such as have prevailed.

"Taking into consideration the value of the stream for disposal of wastes and sewage on the one hand, and the hazard to public comfort and health on the other, it may be concluded that the river should not be so polluted as to constitute a public nuisance, but that it would be impractical at present to reduce the pollution to the extent necessary to make the river below Berlin a stream fit for fishing or other recreational purposes. It would be futile to attempt the restoration of the river to the pristine purity of the distant past. To do so would involve an expenditure for treatment works so large as to preclude continued industrial activity of the type now predominating, and would place unnecessary burdens upon municipalities. The river has been used for many years to remove sewage and the wastes produced by industry. Consequently, the economy of mills and municipalities is predicated in considerable degree upon this use of the river."

After citing the legal actions instituted by the office of the Attorney General of Maine, and the cooperative efforts of industries located along the river, Mr. Chase listed the following as the most recent remedial measures instituted during the past summer:

"1. The reduction of the sulfite liquors discharged by the Brown Company at Berlin to about one-third those formerly discharged when odor conditions were worst.

"2. The storage in the open lagoon and in the adjacent ground of most of the sulfite liquors produced by the International Paper Company at Livermore Falls.

"3. The addition of sodium nitrate near the bend of the pool formed by the Gulf Island Dam."

Massachusetts Surveying and Title Recording Practice Described Before Mapping Division

HISTORICAL DATA on the Massachusetts Geodetic Survey and land titles and title records, as well as details of how the Massachusetts Land Court is cooperating with civil engineers, were presented before the Surveying and Mapping Division. J. S. Dodds, Professor of Civil Engineering, Iowa State College, Ames, Iowa, chairman of the Division's Executive Committee, presided. Papers were presented by E. C. Houdlette, Director, Survey Division, Massachusetts Department of Public Works; Dorr Viele, Boston attorney; and William T. Fairclough, Boston, Engineer for the Massachusetts Land Court.

E. C. Houdlette

Pointing out that the history of the Massachusetts Geodetic Survey, from its establishment in November 1933 to September 30, 1937, had been presented to the Surveying and Mapping Division in the fall of 1937 (see Civil Engineering, December 1937, page 25), Mr. Houdlette traced the work for the past eleven years.

"In spite of the handicaps due to the many interruptions at various times," Mr. Houdlette said, "the survey can point to the following accomplishments:

"Triangulation: First-order adjusted stations, 244; second-order adjusted stations, 389; adjusted intersection stations, 67. Traverse: Extent in miles, 3,000; number of traverse stations, 4,800; average error of closure, 1:35,000. The number of first- and second-order bench marks is 10,000.

"The reproduction section did painstaking work in publishing some 25 volumes covering the results of different phases of the survey. Requests for these publications have resulted in the distribution through 44 states and five foreign countries of approximately 50,000 copies."

Of other work done by the Survey, Mr. Houdlette said:

"On May 7, 1945, the Massachusetts Legislature enacted Chapter 274 of the Acts of 1945 authorizing and directing the Department of Public Works to establish a portion of the boundary line between the cities of Chicopee and Springfield and to define the boundary line by determining the X and Y coordinates, referred to the Massachusetts State Coordinate System of both ends of the line and of the points at the intersection of said line with each existing public way.

"The city line passed through a thickly settled residential section and it was necessary to traverse along city streets that crossed the line. The computed length of the line was 23,858.30 ft while the length of traverse between the two ends was 50,706 ft. This is the first time in the history of the commonwealth that a city or town line has been described by Massachusetts state coordinates and will probably prove to be the forerunner of other similar legislation."

Mr. Houdlette also stated that:

"Since 1940 about 200 miles of state highway traverse has been run on the state system. An outstanding example of the use of the state system for highway surveys is that of the circumferential highway around Boston. This is to be a double-barreled express highway that follows a circuitous route from Gloucester on the north to Nantasket Beach on the south and intersects every state highway leading into Boston. By the use of the coordinate system it has been possible to place parties at widely distributed points along the proposed route, and to tie all surveys together without any equations in bearings or coordinates.

Dorr Viele

In his paper, "History of Land Titles and Title Records," Mr. Viele recalled three phases of title registration in Massachusetts, "the vigorous, independent burgeoning period from 1630 of the Bay Colony under the old charter, the second period as a Royal Province, 1692 to 1776, and thence on." A brief summary of the developments of the second and third periods was followed by the main body of the paper which was entirely devoted to the early period 1630–1692.

After describing progress made in the recording of titles and the difficulties occasioned by lack of adequate methods in the early days, Mr. Viele asserted:

"Until, through precise engineering methods, it became feasible to place across a great country by geodetic survey a network of marked locations and make a record of the whole by the related directions and distances of all its points, to which any land parcel can be tied and easily expressed by coordinates, there was no indestructible larger-than-local-use standard for fixing location."

William T. Fairclough

In his paper, Mr. Fairclough gave a step-by-step description of how engineers making surveys and filing plans in the Massachusetts Land Court should proceed. He stated, in part:

"When an engineer is asked to make a survey and plan to be filed with a petition to register land in the Massachusetts Land Court, he should first study the owner's deeds or other evidence of title, then he should consult the index of registered cases in the Land Court to ascertain whether there are any contiguous to, or in the immediate vicinity of, the locus. If there are, the petition plan, the decree plan, the decree and the certificate of title, if the land is actually registered, should be studied very carefully to get data which might affect the title to the locus.

"The correct data from which to reproduce the street lines must, of course, be secured from the proper authority. Therefore it is necessary to determine whether the street is a town, county, state or private way and also its width. These facts should be noted upon the plan because the judge will state in his order for decree whether the locus will be bounded 'by' or 'by the line of' the street or way. Bounding 'by' a street or way gives title to the middle thereof; therefore it is necessary to know its width. Bounding 'by the line of' a street or way gives title only to the side line thereof. When lines of ways in towns or cities are not well defined, recourse may be had to Chapter 86, Section 1 of the General Laws, Tercentenary Edition. If there are no established lines then occupation should be claimed.

"When property abuts a pond or lake, one should check to see if it is a 'Great Pond' because if it is, the commonwealth owns the land under the pond below high-water mark. When it is a 'flowed pond' the height of mean high water is usually determined by an elevation related to some established datum plane or local bench mark, which should be located and shown on the petition plan.

"When city property is surveyed, the relation of the property lines to the adjacent buildings and the walls thereof is most important. Many times the expression 'line through the middle of an eight-, twelve- or sixteen-inch brick wall' is used in the deeds, making the brick wall a monument; or 'line through the middle of a way ten feet wide' thereby making the way a monument, which must be located accurately from adjacent monuments or by offsets from nearby buildings.

"At least two stone or concrete bounds, not over one thousand feet apart, should be used to form a baseline from which the locus could be reproduced at any future time. I none exist, then the engineer should set them on the street corners of the lot."

Mr. Fairclough urged careful attention to details in order to facilitate the work of both the Court and the engineers, and concluded:

"The engineer of the Court, and his assistants, are always willing to discuss any problems which may be troublesome to the engineers, thereby saving a great deal of time in the end."

Thawed Permafrost Ground Refrozen to Support Settling Structures in Arctic

THREE PAPERS, including one on "Engineering in the Far North," by Charles M. Spofford, of Fay, Spofford and Thorndike, Boston, and professor emeritus at Massachusetts Institute of Technology, were presented at the Structural Division session, over which Prof. J. M. Garrelts, New York, secretary of the Division's Executive Committee, presided. Professor N. J. Hoff, Brooklyn Polytechnic Institute, presented a paper, "Buckling of Rigid-Jointed Plane Trusses," and Prof. Robert J. Hansen, Massachusetts Institute of Technology, presented one on "Controlled Impulsive Loadings of Simple Reinforced Concrete Beams."

Charles M. Spofford

In describing construction work done by his firm in the Far North, Mr. Spofford told of special methods adopted for working in permafrost, permanently frozen ground encountered to depths of as much as 1,500 ft. Heat from structures built in permafrost areas is transmitted gradually into the soil, Mr. Spofford said, and after a period of years a bowl-shaped pocket of thawed material is created under the building and a short distance around it.

"If the soils in the permafrost zone are stable, granular materials," Mr Spofford said, "no serious settlemen will occur. However, in many cases the permafrost contains fine-graine soils with a high moisture conten and upon thawing, the moisture i released and the bearing value i sharply reduced. Many buildin failures have occurred on thi account.

"At one of our bases, a thawin failure occurred in a temporar powerplant and the machine founda tions settled so seriously that it wa thought that the plant would have t be abandoned. Another plant wa under construction at that time o better soil and it was essential tha the temporary plant be kept in opera tion until the new one was ready. W dug down beside the machine founda tions, inserted pipe coils, and circu lated refrigerant in the coils until th ground was refrozen, whereupon th settlement was arrested."

Mr. Spofford told of constructio work in temperatures ranging fro 100 deg above zero to 75 below, an the need for furnishing "a mobi skid shack equipped with a stov available for frequent warming of a personnel not engaged in physica exercise." Winds of 150-mile-an-hou velocity also were recorded, he said.

Soil Mechanics Group Receives Reports from Conference in Rotterdam

REPORTS FROM the second International Conference on Soil Mechanics and Foundation Engineering, held at Rotterdam last June, and three papers by professors from Massachusetts Institute of Technology, Harvard University and Northwestern University, featured the all-day session of the Soil Mechanics and Foundations Division. Frank A. Marston, Boston, chairman of the Division's Executive Committee, presided.

At the morning session the following papers were presented: "Field Measurements of Soil Pressures in Foundations, Pavements, and on Walls and Conduits," by Prof. Donald W. Taylor, Massachusetts Institute of Technology; "Soil Mechanics in the Design and Construction of the Logan Airport, Boston," by Prof. Arthur Casagrande, Harvard University; and "Strength of Natural Clays," by Prof. Philip C. Rutledge, Technological Institute, Northwestern University. The afternoon session was devoted to reports from the Rotterdam Conference, presented by Karl Terzaghi, Consulting Engineer and Lecturer, Graduate School of Engineering, Harvard University; Thomas A. Middlebrooks, Head Engineer, Corps of Engineers, and Chief, Soil Mechanics, Geology and Geophysical Section, Washington, D.C.; Willard J. Turnbull, Embankment Foundation and Paving Division, U.S. Waterways Experiment Station, Vicksburg, Miss.; and Mr. Marston, who is a consulting engineer in the firm of Metcalf & Eddy, Boston.

Donald W. Taylor

"One of the most important current needs of soil mechanics is the determination of the degree of correctness of certain theories and methods of analysis," Professor Taylor stated. "Laboratory tests may sometimes be used for verifications of this type, but more often the only conclusive checks are those based on stresses or displacements observed at important engineering projects during construction. The expense and difficulties inherent in the obtaining of such observations are often almost prohibitive. The benefits to the project at which they are obtained frequently cannot justify the cost; therefore, they fall to a large degree in the category of research. However, they offer the one hope of satisfactory long-range improvement in many methods used in soil engineering."

Professor Taylor reviewed the program of the Corps of Engineers in which field observations of pressures have been obtained at a number of projects by the use of pressure cells. He also commented on pressure cells and difficulties inherent in the interpretation of their data. Citing the fact that inherent difficulties in pressure measurements have prevented complete success in certain projects, Professor Taylor concluded:

"In general, many good data were obtained and the greater precentages of satisfactory readings that have been obtained in later projects indicate that some of the difficulties are being overcome. Because of the critical need of such data, all efforts should be made to inaugurate more programs of this type and to work constantly for better instrumentation and better installation techniques. Unless such aims are always in view, many unsatisfactory results are likely, but with the perfectionist attitude, real progress may be expected in the acquiring of much needed information."

Arthur Casagrande

Boston's Logan Airport was called "a splendid example of the importance of accurate field observations and field tests for solving problems in applied soil mechanics" by Professor Casagrande, who pointed out that on this project important decisions had to be deferred until construction was well under way and until the necessary observations and tests on the clay fill were made and analyzed.

"If similar settlement and strength observations become available for other hydraulic clay fills," Professor Casagrande asserted, "it will eventually lead to a better understanding of the mechanics of consolidation of such fills."

Citing the "many challenging problems in soil mechanics" presented by the design and construction of the airport, Professor Casagrande stated:

"When you see the long, wide runways on which many transatlantic planes are operating daily, it is difficult to visualize that only a few years ago most of this area was water. The fill is made of clay which was dredged hydraulically from adjacent harbor areas. The original ground surface was, on the average, slightly below mean low water. The top layer consisted of a highly compressible, very soft organic silt averaging 5 to 10 ft in thickness. In many borings there was found a thin layer of sand directly beneath the harbor silt. Then followed the typical Boston clay profile, starting with stiff clay which changes with depth to medium and soft clay. The problem confronting us in the summer of 1943 was: 'Can one build a hydraulic clay fill consisting of Boston blue clay on top of a thick foundation of the same clay, such that this fill will form a satisfactory foundation for runways for the heaviest planes?'

"I believe that this project has proved that the increase in strength of a soft clay subgrade due to consolidation under the weight of a substantial thickness of base and pavement should be taken into account to enable more economical designs of airfield pavements for very heavy wheel loads. In fact, on this project, one could not have designed the runways by any of the accepted methods. The novel approach which was adopted is probably more important for hydraulic clay fills than for natural deposits of soft clay."

Philip C. Rutledge

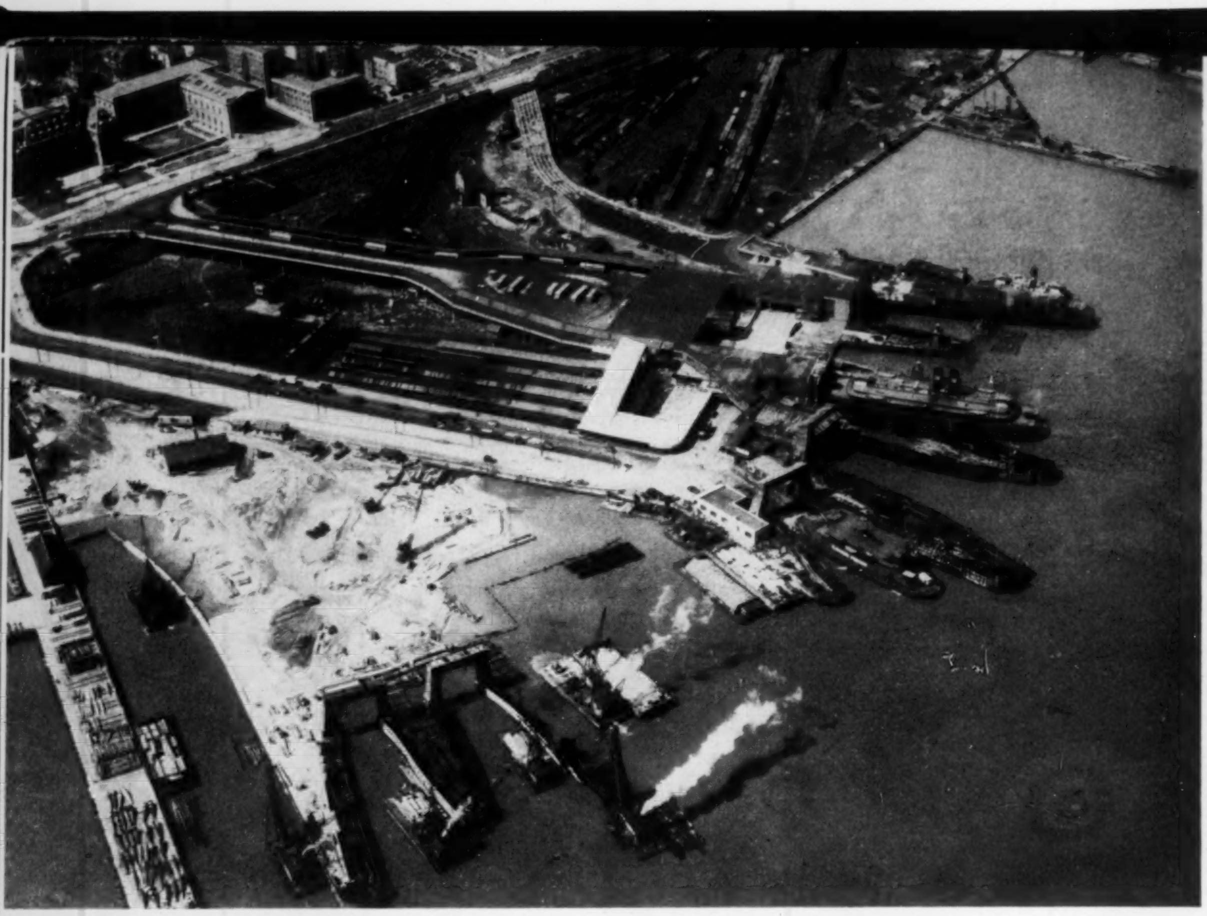
What he termed "a simple and direct method for visualizing and analyzing the strength of a natural clay, believed to include all effects for which there is substantial test or field evidence," was presented in his paper by Professor Rutledge. The method developed from studies made by Professor Rutledge of the researches under the Corps of Engineers' Cooperative Triaxial Shear Research Program.

After detailing the method, Professor Rutledge concluded:

"In its application, only the probable consolidation of the clay need be estimated and the effective strength of the clay is determined. Alternative procedures using Mohr stress diagrams require the determination of 'true angle of internal friction' for the clay and estimates or measurements of pore-water pressures in the field for their application. It is believed that probable consolidation can be estimated with greater accuracy and assurance than pore-water pressures and that, in field control operations, settlement gages can be used more effectively than pore-water pressure gages. The test evidence also indicates that the increase in strength of clay under stress is primarily a function of consolidation and not of internal friction.

"The analyses presented here are applicable only to natural, saturated,

(*Continued on page 80*)



FIRST PERMANENT CONSTRUCTION undertaken on St. George Ferry Terminal, Staten Island, N.Y., includes boat basin (lower left) and adjacent two slips for 69th Street Brooklyn Ferry. To right of boat basin, fill is being placed behind steel sheetpile and concrete bulkhead wall, continuation of which appears as dotted line to right. At top center is seen structural frame for North Vehicular Ramp, spanning tracks of Staten Island Rapid Transit Railway and connecting terminal area with Richmond Terrace. Between ramp and fill at lower left, all existing facilities are to be removed to make way for new facilities.

Staten Island Terminal Provides for Ferry, Bus and Rail Transportation

Design Permits Handling of 31,000,000 Passengers Yearly

E. A. VERPILLOT, M. ASCE

Deputy Chief Engineer and Engineer of Construction, Department of Marine and Aviation, City of New York

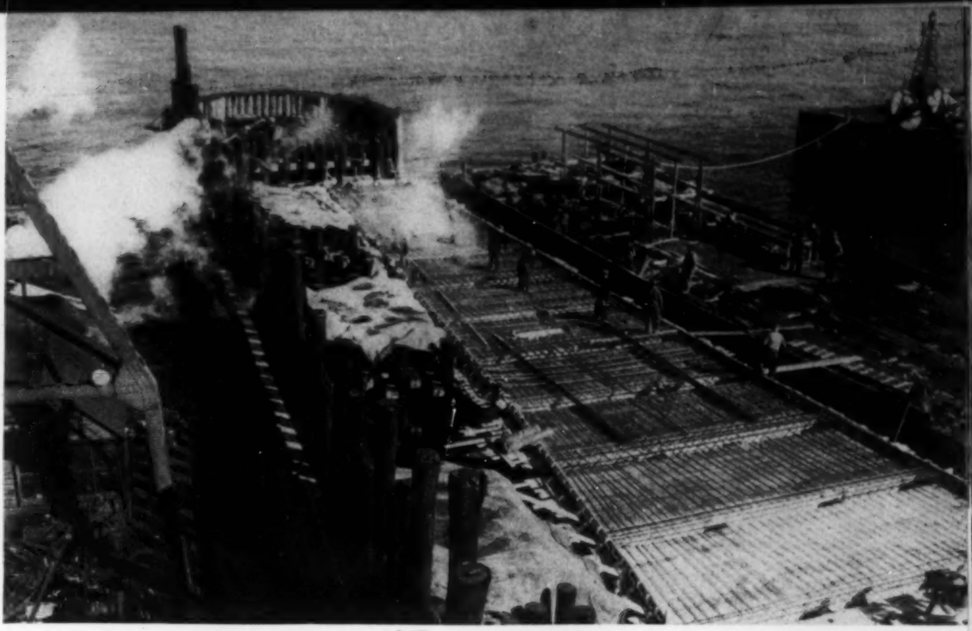
ENGINEERING PROBLEMS of considerable magnitude have been met and solved in the design and construction of the new St. George Ferry Terminal at Staten Island, N.Y., being built to replace the former and obsolete terminal completely destroyed by fire in 1946. Nineteen contracts totaling more than $8,000,000 have been let to date on this project, which when completed will consist of eight ferry slips and a terminal building comparable in many ways with the Grand Central Terminal in New York City, in addition to railroad and highway approaches. Madigan-Hyland are the engineers retained for the work for the Department of Marine and Aviation of New York City, Hon. G. Joseph Minetti, Commissioner, and for the Borough of Richmond, Hon. Cornelius A. Hall, President.

FEW PEOPLE associate a ferry terminal with a project involving any great amount of engineering skill either in design or construction. Ferry terminals, to most of us, are run-down antiquated facilities of an era long past. In many cases the condition of the structures is such as to give the impression of an early if not immediate collapse.

Such is not the case with the new ferry terminal at St. George, Staten Island, N.Y. In many ways it is as modern as the present-day motor car. Its design and construction have posed problems of engineering performance of the first magnitude in the field of foundations, bridge structures, buildings, railroading and mechanical equipment. Design of the terminal and approach structures was complicated by several factors, including: (1) The limited area available for the location of the required facilities; and (2) the great difference in elevation between ground level at the bulkhead and the level of the main approach highways.

The deep water off shore made construction at any considerable distance beyond the bulkhead line prohibitive in cost, whereas the high retaining wall along the street approaches restricted development inshore. It was therefore necessary to squeeze the facilities into this area, overcoming steep gradients in the approach structures by setting facilities at varying levels.

The problem was further complicated by the need for maintaining the present rail facilities, and providing additional rail facilities, in an area considerably reduced over that formerly occupied. Provision of the necessary rail facilities results in limited areas for the location of foundations for vehicular approach structures; consequently foundations must occupy the minimum of space and be located at points which will not interfere with trackage. The latter requirement results in considerable variations in span with the consequence that there is little opportunity to standardize on the spacing of bents or duplication of structural members.



PLACING OF REINFORCEMENT for concrete deck progresses on easternmost ferry slip. At left of pier deck are rack clusters and first row of creosoted timber piles of ferry rack, with some of oak wales bolted in place. Piles in circular row at outboard end are oak to better withstand wear. Timber framework on barge at upper right is device for prefabricating reinforcing mats for concrete bulkhead wall.

In order to reduce the foundation area it was necessary to select a pile capable of carrying heavy loads. Rock is generally found from 3 ft below the ground surface in the area of the railroad yard to 70 ft below mean low water at the outer end of the ferry racks. The rock consists mostly of serpentine with some gneiss, mica schist and quartz. The upper layer for a depth of 2 ft and more is generally decomposed and relatively soft. Wide variations in the elevation of the rock surface not disclosed by borings occur throughout the area.

For example in the abutment foundation of the North Ramp, rock at one end was within 5 ft of the surface whereas at the other end, less than 40 ft distant, it was 20 ft below the surface. At another point, in a single column foundation for one of the approach structures, variations of as much as 14 ft in the depth of the rock surface were found within a distance of 6 ft. It has therefore been necessary to revise and redesign foundations on the spot to avoid delays and increased costs.

It had been hoped to use pipe piles but because of the impossibility of securing pipe within a reasonable period the designer, Madigan-Hyland, designed a composite pile, consisting of an 18-gage metal shell, concrete filled, with an 8-in. H-beam core. Four weights of cores—31, 40, 58 and 67 lb—are provided for design loads of 63, 80, 110 and 144 tons, respectively.

Construction of ferry racks presented considerable difficulty because of limited pile penetration due to the small amount of cover over the rock in most of the ferry-slip areas. This difficulty is being overcome in most cases by placing riprap and driving piles through it. In some locations where there was practically no cover, a trench had to be blasted in the rock and filled with run-of-the-bank gravel. Piles were then driven through the riprap overburden into the gravel fill in the rock trench.

Careful Scheduling of Contracts Required

The necessity of maintaining facilities for the continuous operation of ferries, buses and trains throughout the whole period of construction, and the consequently limited area available for storage and handling of materials tends to increase the difficulty of the work. Careful scheduling of contracts has been necessary to provide for a sequence of construction that will not interfere with the operation of existing transportation facilities and that will provide alternate new facilities prior to the discontinuance of any part of those in use. Work on the contracts has to be closely coordinated to avoid bottlenecks and disruption of existing services.

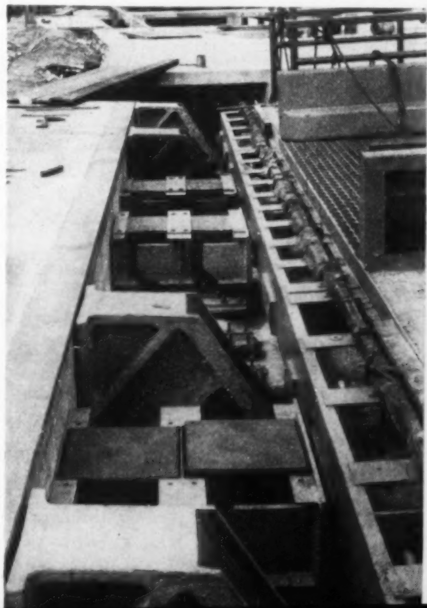
The limited area available for storage and handling of materials has necessitated off-site storage in many cases, the employment of floating equipment to a greater degree than would normally be the case (witness the floating concrete plant shown in the cover photograph, in background between two pile drivers), the use of transit-mix concrete, and the employment of many types of self-propelled equipment. Extensive use of the latter has assisted materially in reducing space requirements and speeding the work.

Unique Design of Ferry Transfer Bridges

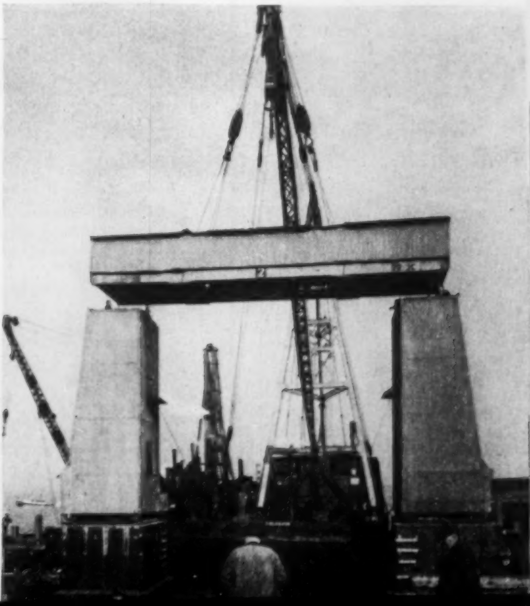
One of the unique features of the design is in the ferry transfer bridges, where large rubber blocks are used to dissipate the energy of the impact of a ferryboat striking the bridge. The shock absorbers consist of a series of rubber cubes set in sliding steel frames located between the hinge end of the bridge and the massive bridge abutment behind the bulkhead wall.

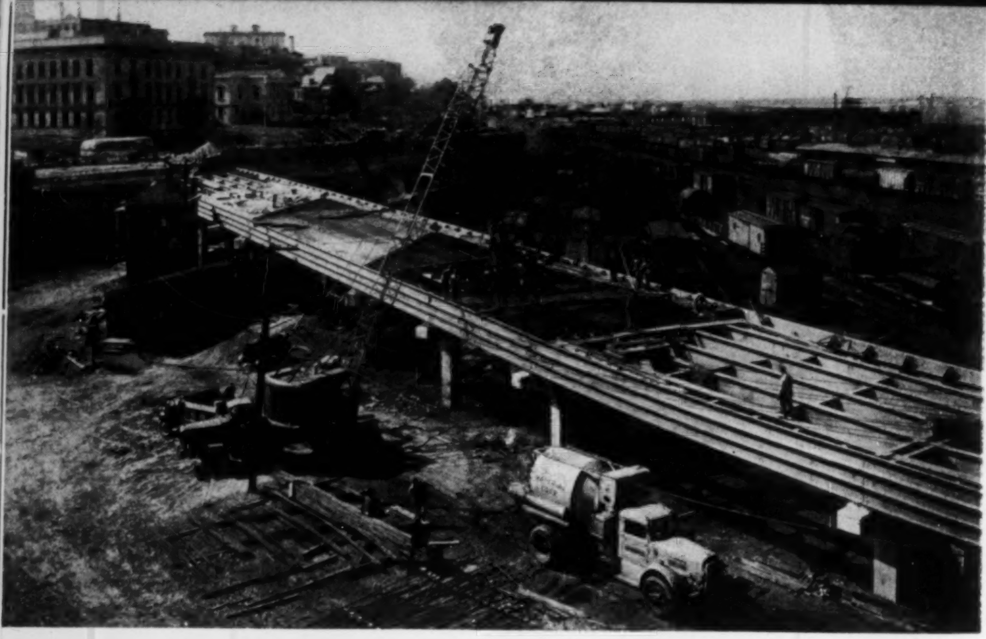
The timber pile and concrete platform formerly used to absorb the

UNIQUE DESIGN FEATURE is transfer bridge buffer and seat assembly (below) in which rubber blocks 18×18×12 in., set in sliding steel frames, take impact of ferryboat. Inclined-plane steel castings support inshore end of transfer bridge and cause it to move upward at impact, thus utilizing dead weight of bridge to further dissipate force of blow.

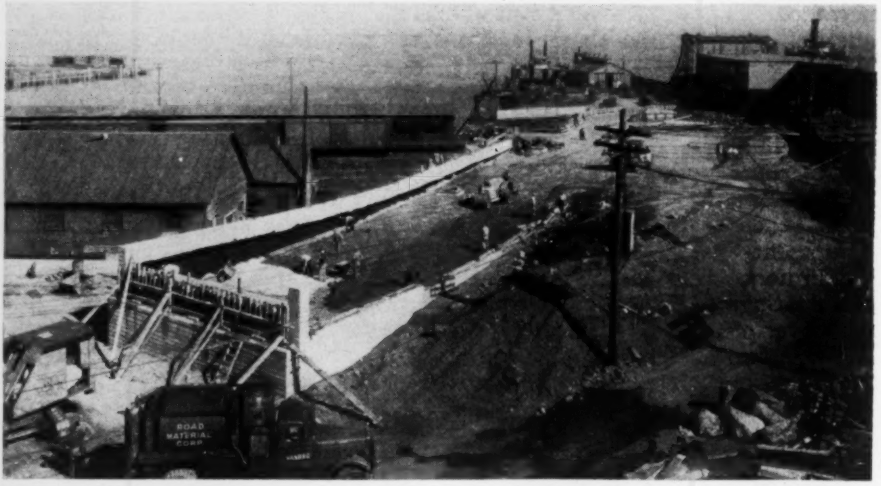


DERRICK PLACES last section of sheet-metal-enclosed steel gallows frame for 69th Street Brooklyn Ferry slip. Heaviest lift is about 30 tons. Removed from discontinued ferry installation in Queens, gallows frame was towed to site and erected on concrete and steel H-pile foundation, which is protected from driftwood and propeller wash by creosoted timber covering.





ALL PHASES OF SUPERSTRUCTURE CONSTRUCTION—structural steel framing, formwork, reinforcing and concrete-deck placement—proceed simultaneously on North Vehicular Ramp (above) over yards of Staten Island Rapid Transit Railway. Non-uniform spacing of supporting concrete bents is due to need for accommodating new track alignment. Extensive alteration of existing concrete retaining wall to provide bridge seat is under way at left above, along edge of Richmond Terrace.



FILL INSIDE OF CONCRETE ABUTMENT is compacted to form approach to North Vehicular Ramp. Buildings at left are part of existing freight sheds of Staten Island Rapid Transit Railway, whose tracks and facilities are to be relocated in later stage of work. Temporary facilities for municipal ferry to Manhattan appear at top right. Viaduct structure was placed in use in June 1948 and completed in September.

shock of docking ferryboats could not be used in this case because of lack of room. Therefore some other means had to be devised for absorbing these shocks. The rubber blocks, roughly 18×18×12 in. in size and ten in number, compress approximately 4 in. in absorbing the impact of the 500-ton ferryboats used on the 69th Street Brooklyn run, when striking the bridge at a speed of about 5 mph. In the slips to be built for the larger municipal ferryboats of the Manhattan run, displacing approximately 2,000 tons, twenty rubber blocks 18×18×20 in. in size will be used. The rubber shock-absorber type of installation, as incorporated in the slips already in use for the 69th Street Brooklyn Ferry, has proved satisfactory in service.

The former Staten Island terminal, which was constructed in the early 1900's, was already obsolete when it was completely destroyed by fire in the summer of 1946. It speaks well for the forethought of the city fathers that plans for its replacement were in an advanced stage of completion at the time of the fire. Immediately afterwards these plans were rushed to completion and at the same time contracts were let to demolish the existing twisted and fire-racked superstructure. Simultaneously plans were prepared and contracts let for the construction of a temporary passenger waiting-room and for the rehabilitation of certain portions of the facilities to permit immediate operation of the railroad, ferry and bus transportation systems.

New Terminal Facilities

The new terminal will include eight ferry slips—six capable of accommodating ferryboats of more than 2,000 gross tons, and two (already completed) for ferryboats in excess of 500 tons—together with modern, double-deck, electrically operated transfer bridges. A terminal building comparable in many ways with the Grand Central Terminal in New York City will provide the traveling public with such conveniences as restaurants, snack bars and modern shops.

Facilities to be provided include not only those for the handling of 31,000,000 passengers and 2,100,000 vehicles per year in connection with waterborne transportation (ferries), but also railroad and bus terminal facilities for handling approximately 10,000,000 and 20,000,000 passengers per year, respectively. An ingenious system of approach structures enters the terminal at various levels for the segregation and safety of vehicular traffic, and passenger ramps for reaching trains and buses are so arranged as to make it impossible for passengers to cross lines of vehicular traffic.

Widening of the existing 250-ft-long railroad tunnel from its present width of 32 ft to 47 ft is included in the contemplated work, and is to be accomplished without interference with the movement of trains. Widening of the tunnel is required to provide room

(*Continued on page 80*)

CONSTRUCTION QUANTITIES PLACED TO DATE

Dredging	118,000 cu yd	Concrete curbing	3,400 lin ft
Subaqueous rock excavation	2,200 cu yd	Concrete sidewalk	3,600 sq yd
Excavation	51,000 cu yd	Bituminous pavement	14,500 sq yd
Riprap placed	112,000 tons	Sheet asphalt	6,200 sq yd
Earthfill	214,000 cu yd	Sewer lines	4,000 lin ft
Steel sheetpiling	700 tons	Water lines	4,000 lin ft
Structural steel	600 tons	Timber	700,000 fbm
Reinforcing steel	250 tons	Steel piles	25,000 lin ft
Concrete	9,000 cu yd	Composite piles	12,500 lin ft
Cement	14,000 bbl	Wood piles	250,000 lin ft

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Hospital Construction for Leper Colony Presents Many Engineering Problems

JOHN W. GREENLEAF, JR., Assoc. M. ASCE
Formerly Sanitary Engineer, Institute
of Inter-American Affairs,
Asuncion, Paraguay

ALTHOUGH THE CONSTRUCTION of a hospital and other improvements in a leper colony are seldom listed as sanitary engineering jobs in this country, there are many tropical and semitropical countries where leprosy is a real problem and its control is an important part in any program of public health. Estimates by competent authorities indicated that in Asuncion, Paraguay's capital city, where the author of this paper was stationed as associate chief of party and sanitary engineer for the Institute of Inter-American Affairs, there were approximately 2,000 lepers out of a total population of 130,000. Difficulties experienced in constructing badly needed new facilities for general improvement of an existing leper colony with a population of 350 patients, established in 1935 at a point 60 miles from Asuncion and 7 miles from the nearest railroad at Sapucay, are described herein. Handicaps of extremely poor transportation, materials shortages and a unique labor problem plus unusual engineering problems were overcome in providing a water supply and other facilities for the colony which included a 60-bed hospital with its dormitories and utility buildings as well as quarters for operating personnel.

UTILITY, APPEARANCE AND ECONOMY are prime considerations in constructing dormitories and hospital buildings of local materials at Paraguayan leper colony. View along dormitory porch shows window shutters suspended from roof and protected from weather. Shutters are provided for two screened sections of each window. Third section is glazed and fixed.

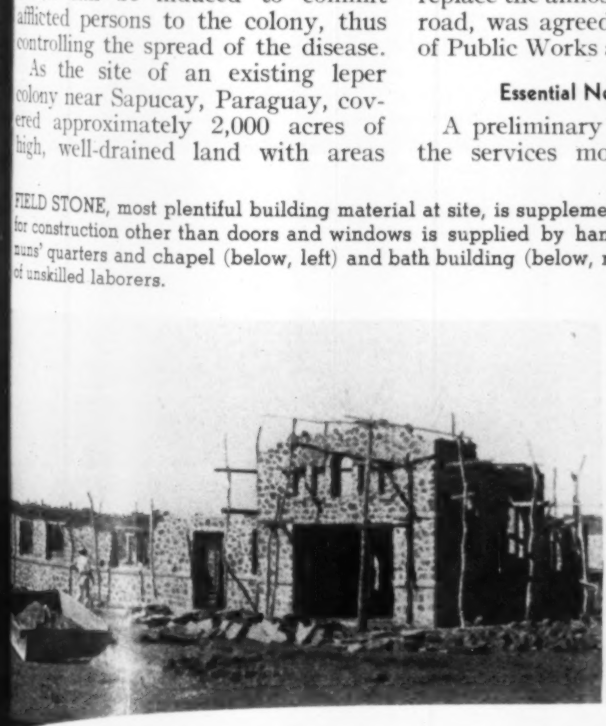
SINCE THE ONLY effective means for the control of leprosy is the isolation of all those afflicted with the disease, at least in its contagious stages, a leper colony to be effective must provide the essentials for the comfort and welfare of its inmates as well as permit easy access under controlled conditions to all those desiring to visit the colony. It is only in this manner that families of lepers and others can be induced to commit afflicted persons to the colony, thus controlling the spread of the disease.

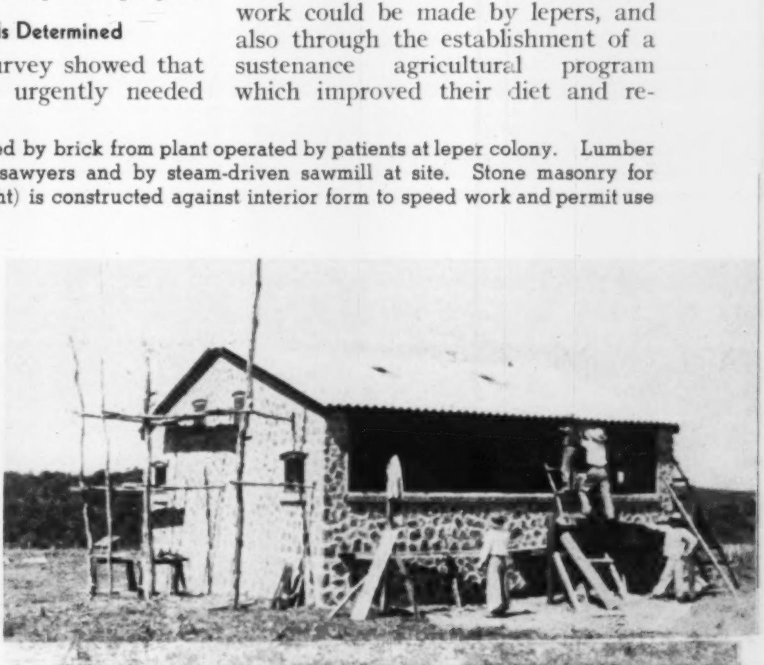
As the site of an existing leper colony near Sapucay, Paraguay, covered approximately 2,000 acres of high, well-drained land with areas suitable for agriculture and livestock raising as well as wooded areas to supply fuel and lumber, and already had a population of more than 350 patients, it was decided to undertake the necessary improvements to the colony as one of Paraguay's leper control projects. The sum of $50,000 was allocated for the work. The construction of a suitable highway between the colony and Sapucay to replace the almost impassable existing road, was agreed to by the Minister of Public Works as a separate project.

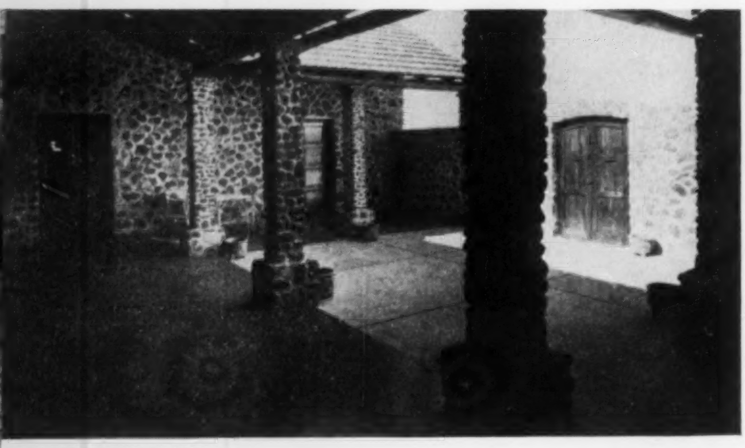
Essential Needs Determined

A preliminary survey showed that the services most urgently needed within the colony were a hospital with adequate facilities for both surgical and medical cases as well as a water system, a laundry, and a bath house—since the individual homes lacked these essential facilities. Opportunity for useful work which could be done by the patients to keep them occupied and permit them to earn money for their personal needs was necessary for the morale of the colony. This need was provided through the construction of a plant where brick for the construction work could be made by lepers, and also through the establishment of a sustenance agricultural program which improved their diet and re-

FIELD STONE, most plentiful building material at site, is supplemented by brick from plant operated by patients at leper colony. Lumber for construction other than doors and windows is supplied by hand sawyers and by steam-driven sawmill at site. Stone masonry for nuns' quarters and chapel (below, left) and bath building (below, right) is constructed against interior form to speed work and permit use of unskilled laborers.







INTERIOR PATIO at nuns' quarters shows interesting treatment obtained through use of local materials and minimum of skilled labor at no sacrifice to principles of sound construction. Large troughs carry away water from rains, recorded as high as 22 in. in 48 hours.

duced the amount of food to be purchased.

Planning and execution of the building program was under the writer's direction. The isolation of the colony and transportation difficulties were deciding factors in the type of construction to be employed, the materials to be used, and the manner of construction as well as the facilities necessary for both the camp and the completed work. The plan evolved for the hospital called for four buildings around a central garden—two dormitories or ward buildings of identical design, a kitchen and laundry building, and a general service building containing an operating suite of four rooms, a laboratory, a pharmacy, and two clinics for outpatients.

Bathing and toilet facilities were provided at the end of the dormitories adjacent to a 24-bed ward, which was divided by partitions and the central corridor into two-bed cubicles. Adjoining the ward were the two-bed isolation rooms, a dressing room, storage room, serving room, and nurses' station, which controlled access to the building. The kitchen, in addition to a large stove with two ovens and the necessary preparation tables and sinks, contained a vegetable storage and preparation room, a dry storage room, and a well-ventilated meat hanging room. The laundry tubs were on a porch and a room was provided for repairs, ironing, and clothing storage. Toilets with lavatories and showers for the use of employees completed the facilities. The operating suite contained an operating room, sterilizing room, doctor's rest room and office, and a toilet for the use of healthy personnel. An entrance hall sufficiently large for use as a post-operative recovery room if necessary was also provided.

Factors Governing Building Design

The design of the buildings had to utilize to the fullest extent possible the materials available at the site and conserve all materials required from outside. It had to permit simple construction that could be carried out with a minimum of skilled labor and provide completed structures that would require a minimum of maintenance such as could be performed by patients with little skill and few tools.

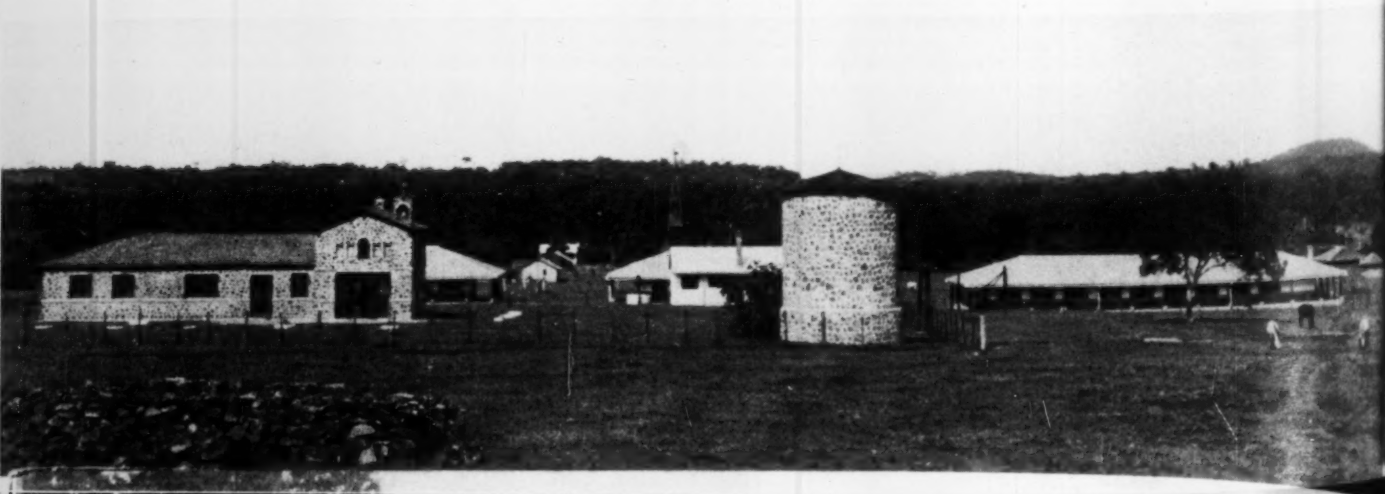
The dormitory design provided for stone foundations and relatively thin stone walls to sill height, surmounted by a brick wall to a total height of 8 ft 3 in. The stone masonry walls were constructed against an interior form which reduced the time required for laying the masonry and made possible the use of a larger number of unskilled laborers in its construction. It was also possible to plaster directly over the masonry for the interior finish. The roof was of hip type, of Spanish tile laid over book tile that extended on all sides of the building to cover an 8-ft-wide porch to shade the walls and help keep the building cool. The double tile roof, used because of its higher insulating value, required that the wall plate beams be tied together with tierods and that roof rafters be notched into them.

Windows 8×8 ft are provided on both sides of the building, one for each room or cubicle, with the result that the brick walls are reduced to piers. The windows are divided into three sections with only the center section glazed. The other sections are screened and there are outside shutters which can be closed in cold or inclement weather. The shutters are hinged at the top and when open are hooked to the underside of the porch roof where they are protected from both wind and weather. A weighted catch holds the shutter under the roof and an extended lever permits releasing the catch from floor level. This arrangement, providing adequate ventilation and reducing the possibility of glass breakage, was easy to install as well as less expensive than the more common casement type of window ordinarily used.

The sanitary facilities, except for flush tanks and a seat toilet, were entirely constructed at the site. Shower stalls, bathtub, lavatories, and squat-type toilets were all constructed of brick masonry covered with cement plaster troweled to a dense and smooth surface. The inside of the bathtub and lavatories was faced with glazed porcelain tile for ease in cleaning and improved appearance.

All floors were constructed directly on the tamped refill. Over a layer of brick, laid flat, was placed 1 in. of cement mortar topped with $^1/_4$ in. of rich mortar impregnated with a red oxide for color. This topping was screeded and then floated with a

DESIGNED WITH EMPHASIS on sanitary features under limitations imposed by labor and materials shortages, poor transportation facilities and limited funds, resulting group of buildings represents well-integrated unit for care of lepers from Paraguay's capital city. Left to right in foreground of picture are completed nuns' quarters and chapel, cylindrical standpipe and dormitories. Windmill in background pumps potable water from 75,000-gal cistern to elevated tank for distribution to water outlets in buildings.



wood float after which it was given a final finish with a rubber-covered wood float. The results were equal to or better than a good steel trowel finish and completely satisfactory for a hospital floor. To avoid cracks from expansion and contraction, the floor was divided into 10-ft squares and the joints filled with an asphaltic compound. Porch floors were similarly constructed except that the color was omitted and the surface left rougher to reduce the possibility of slipping.

GRAVITY-TYPE DAM OF STONE MASONRY, 60 ft long and 12 ft high at spillway, provides water for general use. Attempts at well digging were abandoned after eight months' work without proper equipment revealed presence of hard basaltic rock practically devoid of cleavage planes.

The kitchen and laundry building was built with single-width brick construction both for exterior walls and for partitions, which were plastered inside and out. The roof is of corrugated cement-asbestos sheets supported on light timber framing.

Construction of the general service building was similar to that of the dormitories except for the layout.

Two Water Supply Systems Provided

Water for general use was obtained from a large brook that formed one of the colony boundaries. The water system was provided by constructing a dam and pumping the water approximately 4,000 ft to a standpipe located behind the hospital and 140 ft above the dam. Since some of the surface drainage from the colony entered the brook above the dam it was considered desirable to provide a separate potable water supply. This supply is obtained by collecting rain water from the roofs of the hospital buildings and storing it in a large cistern from which it is raised by a windmill to a small tank in the windmill tower and distributed by piping to outlets in each building.

The dam is a gravity-type structure of stone masonry 60 ft long and 12 ft high at the spillway. It is entirely founded on rock exposed in the streambed at the damsite, into which a cutoff was excavated to insure against piping and to provide a good bond for the dam. Because of the flashy nature of the stream, the entire length of the dam was constructed as an overflow section with a 10-ft weir section in the center for normal overflow. The downstream banks are heavily protected with stone paving to prevent erosion during flood flows which reach almost unbelievable heights. The entire watershed above the dam is steep and the soil is relatively impervious. Since the completion of the dam, rainfalls have been recorded amounting to 550 mm (22 in.) in 48 hours.

At one end of the dam there is a small screen and valve chamber from which a 4-in pipe leads to a surge chamber and then to a hydraulic ram located about 350 ft downstream from the dam where water is raised to the standpipe above the hospital by a force main of $1^1/_2$- and 2-in. pipe. The ram is housed in a heavy vault constructed of stone and reinforced concrete to resist damage from flood flows. The amount of water pumped by the ram varies according to the level in the standpipe, but averages approximately 500 gal per hour, which is more than adequate for the colony's needs.

The standpipe behind the hospital is of stone masonry. A solid mass of such masonry was constructed from a solid foundation to 5 ft above ground and on top was constructed the circular wall which forms the standpipe. This wall was proportioned as a gravity-section wall and carried to a height of 13 ft, then topped with a conical wooden roof covered with tarpaper. The outside of the wall is vertical and the inside battered so as to form an inverted cone for water storage. Waterproofing was provided by a coat of cement plaster, troweled smooth, applied to the inside of the standpipe. When the standpipe was first filled some leakage occurred; however, this soon stopped and subsequent operation has been entirely satisfactory.

STONE STANDPIPE, providing storage on general water supply system, has gravity section walls with no reinforcing. Smoothly troweled coating of cement on interior of tank provides waterproofing.

The cistern for potable water storage, located just beyond the hospital buildings on somewhat lower ground, has a capacity of approximately 75,000 gal. The walls are of stone masonry 24 in. thick, constructed against the sides of the excavation or backed by carefully tamped refill and carried to a height of 13 ft. A 6-in. concrete floor was provided and both the walls and floor were waterproofed with a coating of cement plaster troweled smooth. A tarpaper-covered wood roof excludes light and dust. The windmill was erected with three legs on the cistern walls and the fourth on a pier constructed within the cistern.

The collecting system from the building roofs is of vitrified clay pipe laid below the gradient line to insure internal pressure within the system and thus prevent rodents or contamination from entering. To waste dirty water from the roofs at the beginning of storms there is a single chamber at the entrance instead of separate valves at each downspout as commonly provided.

Construction of Brick Plant

In anticipation of the needs of the building program and to provide immediate work for able-bodied patients, a brick plant was constructed as the first step in the project. The plant was started in June 1943, when a man experienced in local brick-making procedures was sent to the colony. The plant consisted of a drying shed, 40 × 200 ft in plan, a kiln of the fixed-wall type, and a vertical hand-charged, horse-drawn pug mill. The drying shed had a thatched roof supported on rows of posts, with no walls, and an earth floor. Work on the construction of the brick plant was completed in

HYDRAULIC RAM CHAMBER located 350 ft downstream from dam is heavily constructed to withstand flood flows. Ram raises water 140 ft in pumping about 500 gal per hour a distance of 4,000 ft to standpipe which is in vicinity of hospital building.

December 1943, and production of brick and book tile was begun. Because of the inability of the lepers to work a full day or to produce as healthy workers would, the manufacture of brick proved to be slow and costly. Nevertheless, practically all the brick and book tile required by the project, totaling 156,000 brick and 14,000 book tile, were produced in the plant, which was easily accessible to the construction site.

Construction Camp Set Up

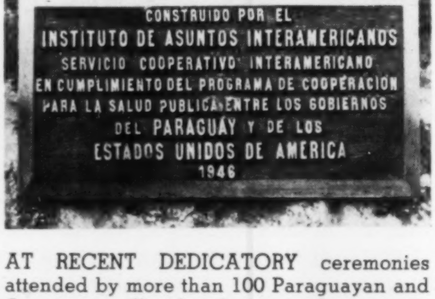
The first step in the construction program was the erection of a construction camp near the administrative headquarters of the colony which is situated in the "healthy" zone and near the road to Sapucay. The camp as constructed consisted of two main buildings. One building, 27 × 66 ft, provided office and living space for office personnel, a central warehouse section, and a dormitory at the opposite end for workers; the other, 27 × 33 ft in plan, was used as a dressing room, and shower baths were provided in an enclosure adjoining it.

A small cabin which served as the project superintendent's office and quarters, a shed used as a kitchen, and a small building for the cook's quarters completed the camp. The two principal camp buildings were of country-type construction and were built by a local contractor for 1,400 Guaranies ($438.72) which included the furnishing of all labor and materials. These buildings had thatched roofs, "French walls," and dirt floors. The roofs, of locally cut grass bound together with mud and supported by split bamboo sticks, were carried by poles to longitudinal members which were supported by forked posts erected as the first step in the building construction. After the completion of the roof, the walls were built, consisting of closely spaced rows of sticks driven into the ground between the posts and woven together with smaller sticks and vines. Over this framework mud was plastered to the desired thickness, usually about 4 in., after which a coat of whitewash was applied for protection from the weather and for cleanliness. The upper 2 ft of the side walls was left unplastered to provide light and ventilation. Brick floors were added later to reduce dampness and aid in cleaning.

A central partition divided the dressing-room building into two parts, each served by a separate entrance and connected only through the baths. One side was for workmen coming from the colony to leave their dirty and possibly contaminated clothes before bathing and dressing in clean clothes. Within the baths six shower heads were provided for general bathing while two were supplied with a strong disinfectant, followed by two more with clean water for rinsing.

Precautions Taken to Protect Workmen

Sanitary bathing facilities were but one of a series of precautions taken to protect the workers from contacting leprosy. All areas in which work was to be carried on within the infected zone were first enclosed in barbed wire and provided with a locked gate, after which they were burned or flamed with a torch before work was started. Brick manufactured by the lepers was not touched by them after burning. Transportation between the camp and the work areas was furnished by truck and medical attention was provided even for minor cuts and bruises. Any workman found associating or dealing with patients was immediately discharged.



CONSTRUIDO POR EL
INSTITUTO DE ASUNTOS INTERAMERICANOS
SERVICIO COOPERATIVO INTERAMERICANO
EN CUMPLIMIENTO DEL PROGRAMA DE COOPERACION
PARA LA SALUD PUBLICA ENTRE LOS GOBIERNOS
DEL PARAGUAY Y DE LOS
ESTADOS UNIDOS DE AMERICA
1946

AT RECENT DEDICATORY ceremonies attended by more than 100 Paraguayan and American officials, bronze plaque was placed on hospital crediting construction to Institute of Inter-American Affairs, Inter-American Cooperative Service, and commemorating fulfilment of program of cooperation for public health between governments of Paraguay and the United States.

These precautions, in addition to protecting the Inter-American Cooperative Service from any claims that workmen had contacted leprosy while in its employ, assisted materially in overcoming the fear of working at the colony and made it possible to obtain workmen at the prevailing rates of pay. The lepers were very cooperative in this program and gave no cause for concern.

The water supply for both the camp and the construction work had to be hauled, since the wells attempted were failures. A small stream within the colony was dammed and a hand pump was mounted on a platform for filling a 750-gal tank mounted on a truck. A small cistern was built at the hospital where water hauled by the truck was stored for use as needed. At the end of the day the truck tank was filled with water and hauled to the camp, where it was raised by a chain hoist to a platform. A short hose connected the tank to the showers and other water outlets within the camp. Water for drinking and culinary uses was hauled in barrels from a spring located a considerable distance outside the camp.

In addition to the production of brick at the colony, all timber and other wood necessary for the construction, other than doors and windows, was cut from trees found on the colony. A small steam-driven sawmill owned by the colony was utilized throughout most of the construction period, but because of its limited capacity had to be supplemented with three teams of hand sawyers. Usually the logs were squared and the larger timbers cut by machine, after which further cutting was done by hand to the required dimensions. The limitations of the sawing facilities made it necessary to economize on the use of wood as much as possible in the building program.

Field stone was the most plentiful building material and was available in abundance within the colony, but because of the possibility of its being contaminated, all stone for construction was hauled in from outside the boundaries of the colony. Sand proved to be both difficult and costly to obtain. There were no natural deposits in the vicinity except for small amounts in some of the streambeds and dry washes which were inaccessible; therefore all sand used had to be hauled 15 miles by oxcart over all but unpassable roads.

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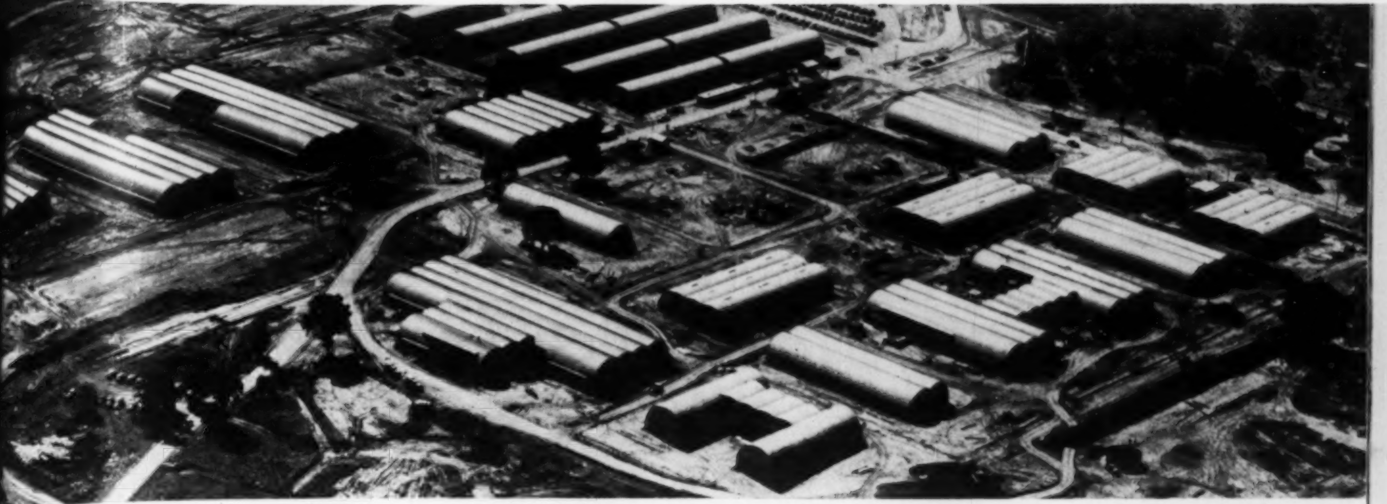


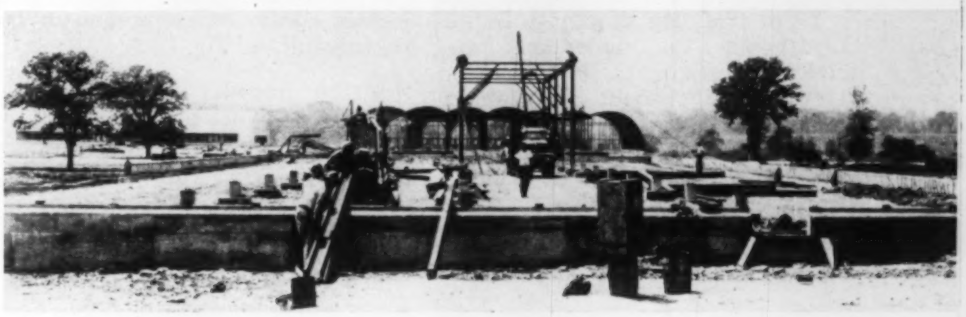
TWENTY-FIVE QUONSETS, covering nearly 307,000 sq ft, comprise laboratory headquarters of Argonne National Laboratory. Second group of eight Quonsets (not shown), covering 48,240 sq ft, for administrative and service headquarters, is also included in project initiated in March 1948, seven months before above photograph was taken. Buildings, all one story, about 20 ft high, range from 40×60 ft to 100×260 ft. Variation is created by joining units of differing widths and lengths to form T- and H-shaped units.

Quickly Constructed Quonsets Provide Eight-Acre Laboratory for Atomic Research

ERECTION OF 33 buildings covering more than eight acres in a period of seven months was recently accomplished in building the Atomic Energy Commission's new Argonne National Laboratory in Du Page County, Illinois, some 20 miles from Chicago. Research to be conducted in this group of buildings is described by the Atomic Energy Commission's chairman, David E. Lilienthal as "probably the most important" laboratory in research bearing on the national security.

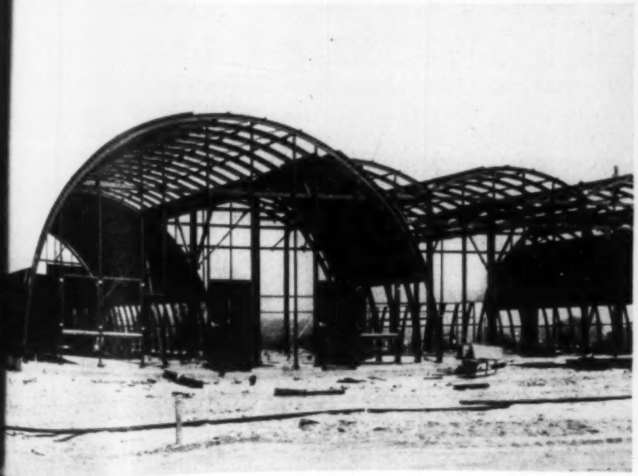
Consolidation on one guarded site of research activities which have been in progress at several locations on the campus of the University of Chicago is the ultimate objective of the project, scheduled for completion in 1950. The University operates the project under a contract with the Atomic Energy Commission entered into two years ago. The new laboratory, in which 29 other Midwest educational institutions participate, is the Commission's center for reactor development, associated research and general coordination of nation-wide effort.

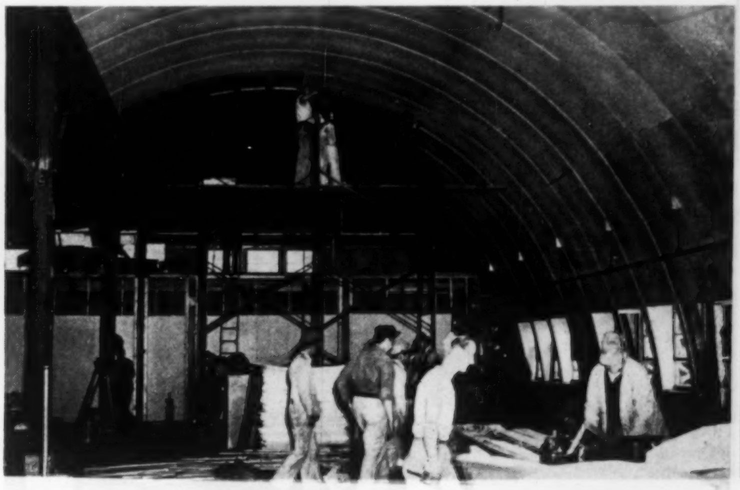
Consolidation of the laboratories now—months earlier than would have been possible with conventional construction—is credited to civilian development of a building originally devised for military use—the Quonset. Economy, availability, fire safety and durability were the factors considered in deciding on this type. A further phase of the project is the erection of more elaborate structures on which construction is about to begin after months of planning.

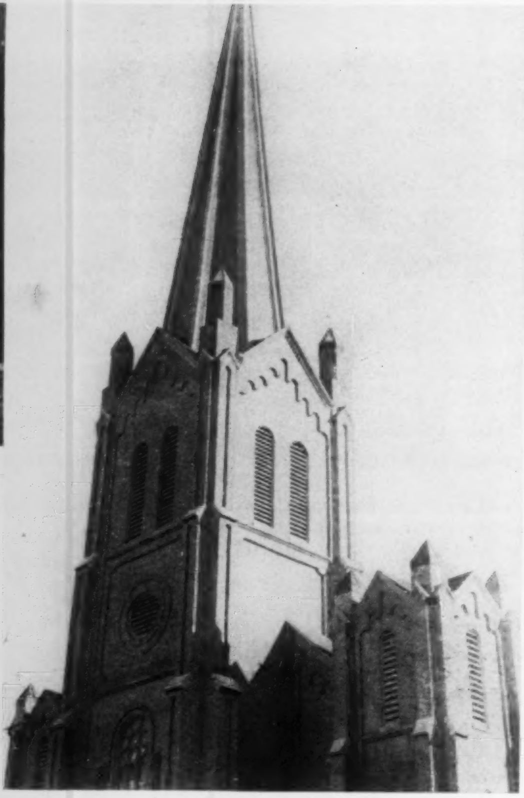


SECTIONS of factory-fabricated framework, shipped in packages, are placed on previously prepared foundation (right). Special equipment used by erectors, Metal Structures, Inc., is limited to light-steel fabricating machinery, two trucks with booms for raising units after ground assembly, and hoist-equipped tractor for site delivery of packaged material.

UNUSUAL ARRANGEMENT OF STANDARD PARTS makes up framework for H-shaped Quonset (below, left) composed of two parallel units 40 ft wide and 80 ft long connected at their centers by third unit 120 ft wide and 40 ft deep. Parts are fabricated and packaged in Ecorse, Mich., and Terre Haute, Ind., plants of Great Lakes Steel Corp., then shipped by rail to Lemont, Ill., and trucked 4 miles to site. Rapid finishing of interior of Quonset (below, right) is aided by use of Stran-Steel arch ribs to which interior wall material can be nailed directly. Outer Quonset covering of corrugated steel sheeting is also nailed in place.







INTERIOR LINING OF REINFORCED CONCRETE supports spire and damaged brickwork without changing exterior appearance of 85-year-old structure.

Concrete Prismatic Shell Reinforces 85-Year-Old Brick Church Tower

A. ROGER KELLY

Engineer, Seelye, Stevenson & Value, Consulting
Engineers, New York, N. Y.

AN ENGINEERING APPROACH to the problem of rehabilitating brick bearing walls which have disintegrated after many years of service has removed the possibility of imminent collapse of the tower structure of the First Presbyterian Church on Chenango Street in Binghamton, N.Y. Constructed first in 1860–1862 and rebuilt in 1863 after a destructive fire, the old structure was recently reinforced from within by means of a concrete prism which supports the shattered brickwork and provides ample resistance to racking wind forces. Solving the problem by means of the prismatic shell precluded the need for removing the steeple or for changing the exterior appearance of the 85-year-old structure.

WHILE MAKING repairs necessitated by a fire in the nave of the First Presbyterian Church in Binghamton, N. Y., in 1946, the Vincent J. Smith Construction Co. discovered pronounced bulging in the brickwork of the tower walls about 50 ft above ground level. An area of brick was dislodged and fell about 10 ft to a platform above the organ loft. Shoring was installed immediately and the engineering firm of Seelye, Stevenson & Value of New York, N.Y., was called in to make a thorough investigation.

Inspection of the interior brick face of the tower disclosed that the units had developed a spongy character and that the surface was flaky and chipped easily. Although the jointing was of lime mortar and easily chipped, the general alignment of the brickwork was still true. However, it was possible to drive a bull-point into the wall with little difficulty. The brick generally appeared to be underburned and to have suffered deterioration from repeated freezing and thawing. The bulging of the tower walls had occurred at a point on the north and south walls where, because of a differential settlement of about an inch at the foundation, the main gable wall had exerted a thrust against the tower walls producing a diaphragm action in this area and resulting in a total deflection of 3 to 5 in.

Some cracking had occurred in the walls at the approximate elevation of the bulges 40 to 50 ft above grade. It was evident that the brickwork of the tower was no longer qualified to continue to resist the heavy rocking stresses produced by the spire projecting above. (See accompanying photograph and Fig. 1.)

Spire Supported by Brick Tower

The brick tower is about 90 ft high and supports a graceful wood-framed spire 60 to 70 ft tall. This spire is supported partly at the top of the brick tower walls and partly on four 12 × 12-in. timber posts 65 ft long which extend about 50 ft into the tower and are supported on two 12 × 14-in. timber beams framed into the north and south tower walls.

Thus the vertical load support has a redundant characteristic but the wind stresses due to the spire movement are transmitted to the tower walls by the four posts through three timber collars framed into the tower walls and spaced about 12 ft apart between the post supports and the top of the wall. Considerable sway was observed in the spire—as much as 18 in. at the peak. Movement of the bracing collars had torn out sections of the brickwork and dry rot had destroyed some of the collar beam ends.

The tower foundations were inspected and found to be of a limestone ashlar founded on a sound gravelly sand material. The foundations were in fairly good condition although some fractures were in evidence. The inside dimensions of the tower are 21 ft square and of the foundation walls 17 ft square.

Inspection and analysis indicated that the 22-in.-thick tower walls were in an unsafe condition, that sections of the inside face of the walls might collapse at some time in the future, and that there was no possibility of anticipating such a collapse.

Since the church membership desired to retain the tower and spire without change in their outward appearance, the engineers decided that the most feasible solution was to construct, inside the brick tower, an independent reinforced concrete tower which would support the spire, absorb its sway, support the brickwork against collapse and at the same time produce no added load on the foundation walls. Though punctured with numerous openings (Fig. 1), the shell or lining would be designed to have prismatic qualities as regards its load-carrying and sway-resisting characteristics.

As the first step in the construction procedure a 17-in. mat was poured on the subgrade at the basement level. Because of the difference in dimensions between the foundation and the tower walls the concrete walls were supported on cantilevers at the vestibule level. To produce the required stiffness, the old wood framing was removed at the vestibule level and replaced with a concrete slab. At this point the design was beset by additional difficulties. The northeast and southeast corners of the tower were each punctured by two doorways. Since it was highly undesirable for esthetic reasons to block up these doorways to gain corner support, the walls had to be supported above the doors on interlocking cantilevers.

Then other difficulties arose. The tower space above the vestibule contained an organ and the east wall at this level was pierced by an arched opening 17 ft wide and 22 ft high plus doorways in the north and south walls over those in the vestibule below. This problem was solved by introducing at the level of the organ a concrete arch supported on columns in turn supported on the cantilevers below. In this manner the large opening in the prism was reinforced and its unity of action was maintained.

Lateral Bracing Beams Resist Thrusts

The thrusts where the bulges occur are resisted by concrete lateral bracing beams built into the north and south walls and bearing in the east and west walls. At the top of the concrete wall the timber framing at the base of the octagonal spire is tied down with steel straps embedded in the concrete. Throughout the height of the concrete lining, keys were cut in the brick wall to provide additional bonding strength.

To avoid placing any additional load on the old walls and foundations and to prevent any deflection that would destroy the bond between the brick and the concrete, the foundation slab was separated from the concrete shell walls at the basement level. The weight of the concrete walls was transmitted to the slab by 16 steel wedges, 4 in each wall, by means of which the subgrade was prestressed once when the walls were at organ-loft level and again when they were at full height. The total deflection induced was $^{3}/_{8}$ in. A check made after the work was completed showed that the sway of the spire had been reduced to less than 4 in. under high wind conditions.

The work here described was supervised by Charles Slack for the Vincent T. Smith Construction Co. under the direction of William Brewster, vice-president. For Seelye, Stevenson & Value, the writer was the engineer in charge, and the design was checked by H. S. Woodward.

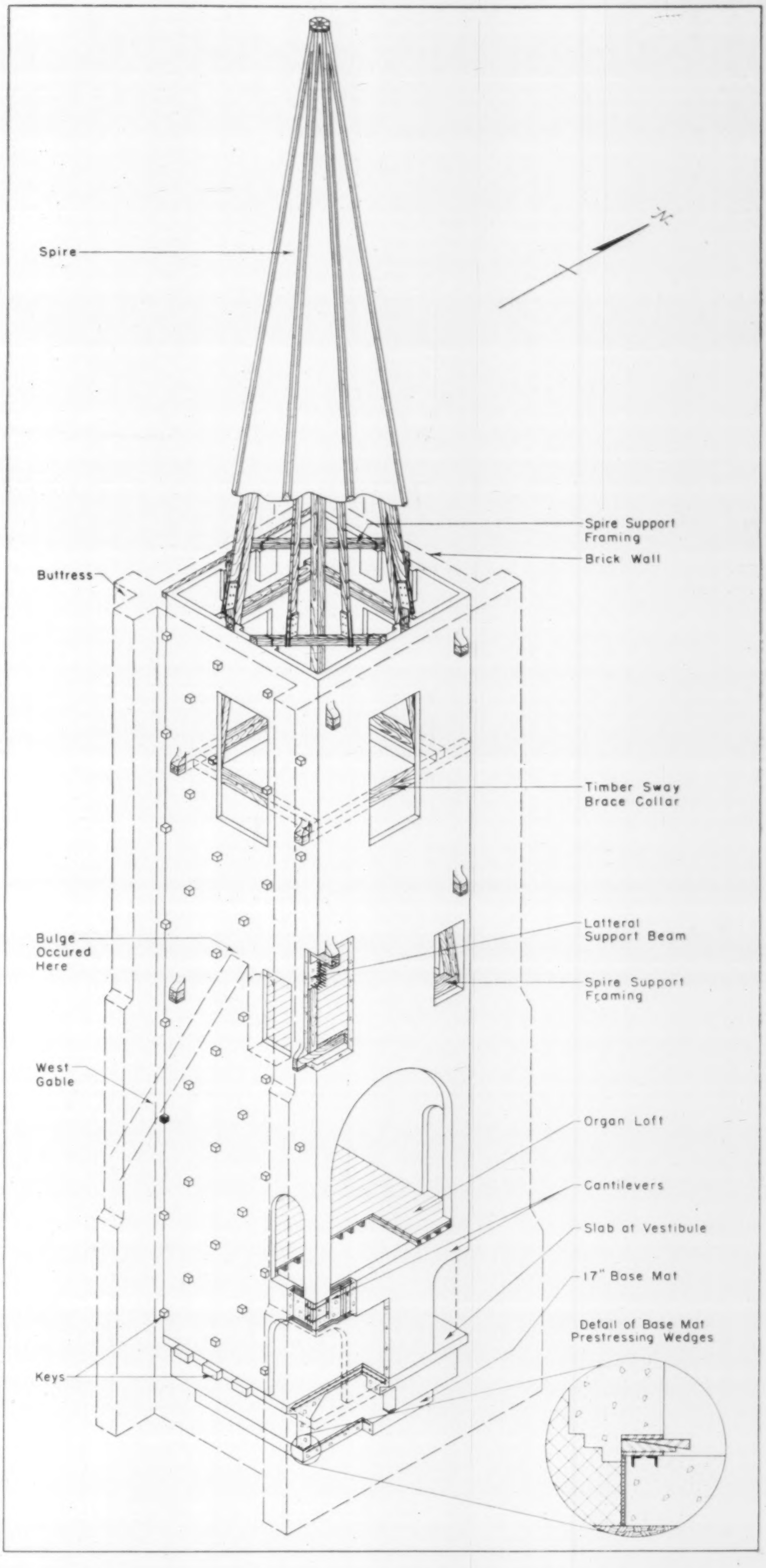


FIG. 1. CONCRETE SHEET REINFORCEMENT for main tower supports brickwork against collapse but adds no load to foundation walls. Concrete walls are supported on cantilevers at vestibule level.

Elements of Planning a Union Bus Terminal

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Parsons, Brinckerhoff, Hall & Macdonald,
Consulting Engineers, New York, N. Y.

TWO ITEMS that do not appear to have been fully exploited in planning union bus terminals are: (1) The economics of location; and (2) the overall operating characteristics. All too frequently it is found that after a terminal is opened for operation, its effectiveness is minimized by certain poor features of these basic aspects. There are many instances where these facilities yet unamortized have lost much of their value as a terminal point of operation and are contributing to general traffic conditions already acute. Fundamental considerations in planning the essential elements of a modern union bus terminal, based on thorough engineering studies, are reviewed here.

CONSIDERATION of a central point of operation for any mass transportation facility involves the analysis of two principal elements: First, the operating characteristics offered by the particular location, and second, the economic factors involved in achieving these operating characteristics.

One of the principal requirements of location is the relation of the facility to the center of passenger commutation. Factors such as proximity to employment concentrations, shopping sections, and other modes of transportation are of prime importance. Of importance, too, in selecting a terminal site is the consideration of existing vehicular and pedestrian traffic and its integration with transportation schedules. This aspect, however, is usually not so difficult to handle because of its flexible nature and adaptability to regulation by mechanical means.

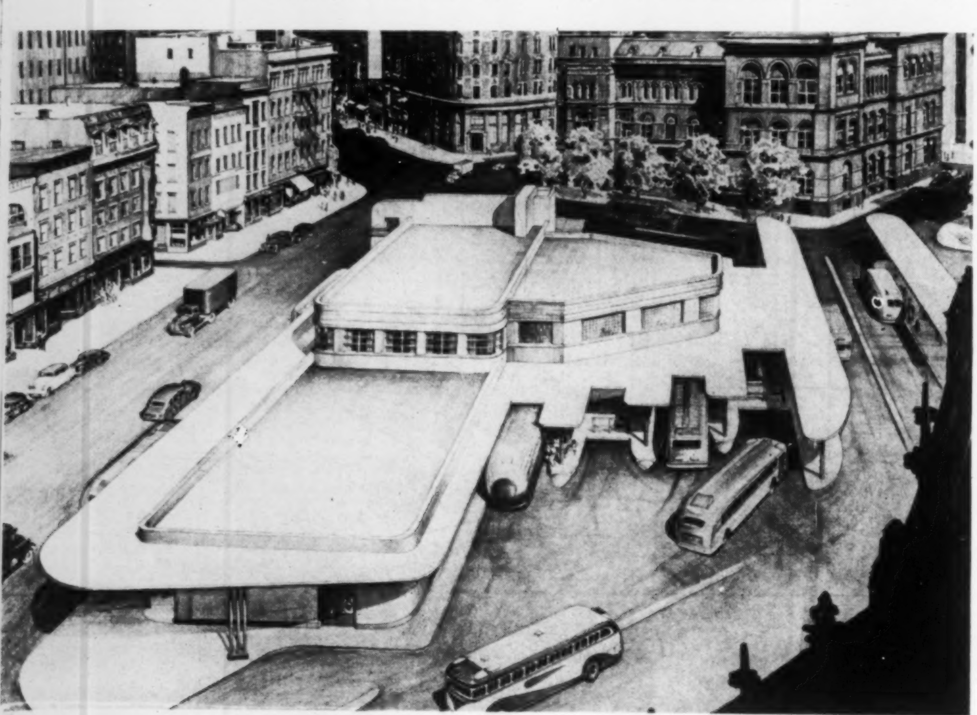
The actual selection of the site should stem largely from a review of factual data obtained from appropriately specified field surveys. Certain factors which on the surface may appear unimportant, often obtain considerable importance in the light of such studies. A study recently conducted in an upstate New York city revealed that the center of employment for more than 20 percent of the urban and suburban commuting labor force in the business section was located about a half mile from the existing terminal. Further, as regards the interchange of passengers, the study showed that approximately 20 percent of all persons leaving the present bus terminal arrived there via railroad facilities, and that 12 percent of all outbound long-haul passengers utilized the local bus lines in arriving at the terminal. These data are significant in connection with operation.

Site location with respect to the existing street system should also be carefully considered. The number and width of streets radiating from a proposed site will have a material effect on the operation of the terminal facility. An off-street location on a through highway will usually offer decided advantages in directness of traveling, maneuvering and parking.

In selecting a location for a terminal, it is desirable to choose a site that effects as little change as possible in well-established existing routes. Traffic flow data should be analyzed from the standpoint of control of all vehicular traffic under proposed terminal operation. Because of its cyclic nature, pedestrian and passenger traffic to and from the terminal must also be given due consideration. Factors such as peak traffic periods and volumes have a definite relation to vehicular traffic and must be controlled accordingly.

Basic Economic Considerations

The economic considerations involved in the development of a bus terminal are primarily the cost of the land, the cost of the terminal building, and the relation of operating costs to income. A review of a number of these developments will show that their costs vary in a wide range, but in general are proportionate to the size of the city. It is of interest to note that in some instances in the past, land acquisition has represented nearly two-thirds of the total investment. Because it is difficult to estimate accurately the future changes in bus service, the economic size of the terminal is perhaps one of the most difficult phases to determine. It is, of course, fundamental that the facility should provide efficient service for



COMBINED LONG-HAUL AND SUBURBAN TERMINAL has fixed and "run-through" type loading dock arrangement and covered passageways, as shown in artist's conception of well-integrated unit. Waiting and baggage rooms, ticket offices, restaurant, and concessions are located on first floor. Rest rooms, manager's office and facilities for operators, representatives, and drivers, available on second floor, are all part of modern terminal.

a normally expanding business during its economic life. Nevertheless, because commutation demands cannot always be accurately forecast, a terminal may be prudently designed for future expansion and yet may never be fully utilized. Conversely, the ultimate development may be greatly exceeded, necessitating the construction of a supplementary terminal. These requirements constitute the principal problem of economic site location and should be determined through a careful appraisal of the municipality's economic activities and the commutation habits of its people.

The over-all development of a bus terminal is controlled by the type of service rendered by the lines using it and whether it is proposed to have all, or perhaps only one or two, types of service operating from the terminal. Obviously, the more centralized these various services can be, the greater will be the return in both investment and service. Where diversified services exist, however, it is the exception rather than the rule to find a single location that will suit both present and future operating requirements of all the lines using the terminal. For an all-service terminal the problem of site selection is made more difficult by the requirements of proper location with respect to centers of commutation.

Facilities for Long-Haul Service

Long-haul bus service is usually conceived as applying to those lines requiring facilities for ticket sales, baggage handling, waiting and rest rooms, and offering transportation to points other than in nearby suburban areas. For this type of development, the location requirement is not so severe since daily long-haul bus commutation is negligible. However, a combined local and suburban terminal should be established as near the center of urban commutation as economically practicable. In satisfying this requirement the cost of land acquisition represents a sizable part of the total cost because the site is usually in an area of relatively high land values. On the other hand, the cost of the facility itself is less than for a terminal required for full-scale operation since the design can provide for shelter only.

Requirements important to long-haul operation, such as proximity to business and shopping areas and to other local lines, must be adequately satisfied by this type of development. It should also be kept in mind that the operating characteristics and capacity of a particular site can often be improved by the development of a supplementary standby area in the vicinity, operated as an integral part of the terminal. Although such a supplementary site represents an investment in land from which little or no direct income is realized, it nevertheless permits the terminal facilities to handle a larger volume of traffic and the resulting increased income should be credited to the standby area.

Actual bus movements in the area selected can be studied best from volume and classification flow charts. The routes used and the relative number of buses arriving at and departing from a given location should be investigated for both peak and 24-hour periods. Time schedules can be conveniently studied from arrival and departure charts, and all these basic data, when combined, will permit the preparation of a master arrival-departure chart which will in large measure determine the docking requirements. Physical dimensions should be specified with due consideration, so far as practical, of the trend toward larger equipment.

The design of loading docks is determined by the nature of the service. Such docks may be either the fixed or the run-through type, or even both. For long-haul service, the fixed type offers certain advantages since the docks are usually occupied for longer periods of time, whereas the parallel or run-through type offers more latitude for handling heavy peak-hour suburban traffic. The areas to the rear of the loading docks provide space for vehicle maneuvering, and strict prohibition of pedestrians must

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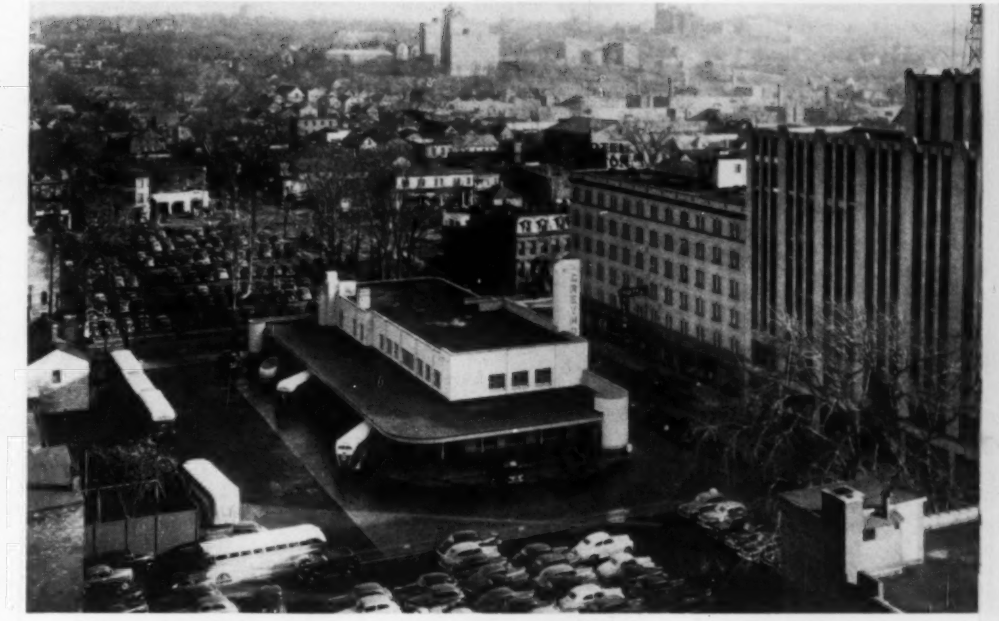


COVERED LOADING PLATFORM of sawtooth type permits ten buses to load and unload simultaneously while 20 more can be cared for in space back of docks. Modern terminal of Central Greyhound Lines in Syracuse, N.Y., is constructed of concrete, cut stone and steel. Exterior is faced with ceramic glazed gray brick. Large vertical porcelain enamel neon lighted sign adjoins one end of marquee. Waiting room is approximately 3,350 sq ft. Concessions consist of travel bureau rooms, telephone and information rooms, restaurant accommodating 96 persons, offices of terminal manager, rest rooms and parcel locker

TERMINAL LOCATED AT EDGE OF BUSINESS DISTRICT in Houston, Texas, is close to number of hotels and union railroad terminal, thus meeting requirements for "economical location." Loading platforms located in rear are of parallel "run-through" type. Structure operated by Greyhound includes restaurant on ground floor with accommodations for 180 people and provides both counter and cafeteria service. Recent passenger volume estimates indicate 15,000 to 18,000 passengers use terminal daily.

Deferred Maintenance Endangers Sea Wall on China's Chien Tang River

Ancient and Modern Methods Combine to Protect Hangchow Bay Area from Destructive Action of Tides

ARNOLD N. MAY, Assoc. M. ASCE
Consulting Engineer, China Relief Mission; Conservancy Engineer, Chien Tang Sea Wall Project, Hangchow, China

OVER THE CENTURIES a strange phenomenon, widely known as the Hangchow Bore, has inflicted tremendous damage to waterfront structures and land bordering the narrowing mouth of Hangchow Bay and the Chien Tang River in China. The kinetic force of the rumbling wall of water entering the bay at each full moon has a particularly destructive effect on the Chien Tang Sea Wall designed to protect adjoining farm lands from the ravages of tidal-like waves which reach heights up to 20 ft. The wall has been repaired and sections rebuilt many times over the past 1,000 years by laborious methods and crude hand tools. Measures initiated by UNRRA and CNRRA in repairing the damage resulting from lack of maintenance during the Japanese occupation of China introduced the use of heavy equipment and modern engineering practice in solving the age-old problems. The four phases involved in the execution of the work and the details of solving this unusual river control problem are described here.

ABOUT 1,000 YEARS AGO during the reign of Prince Chien, the Chien Tang Dike was built on both sides of Hangchow Bay, for a length of 190 km on the north bank and 118 km on the south bank. The main wall of ashlar stone is 6 m high, 6 m wide at the base and 2 m on top, and is set on wood piling backed with a dike of earth. The base is protected by two approaches, both of stones. This massive wall protects about 10,000,000 mow (6 mow = 1 acre) of farm land and 7,500,000 inhabitants.

"THE COUNTRY MEETING having decided to build a dike 100 li long in the east of the Hsien, announced that those who would carry earth for dike building would be paid with 1,000 chien for each hu of earth. In the first ten days many responded to this call, but all left before the work was completed. It was called the Chien Tang." This quotation from Chang Chi Chein's *History and Geography of Chekiang Province* recounts the birth of the Chien Tang Dike.

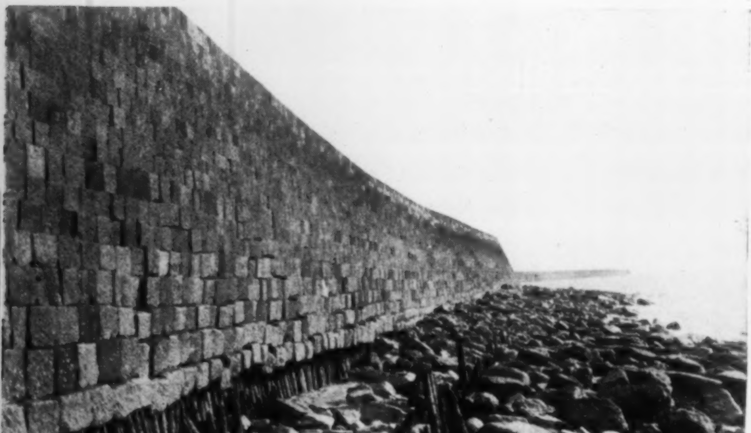
During the occupation by Japanese forces, the approaches were not maintained and therefore were washed away, exposing the pile foundation. The inrushing waters of the tide undermined the wall; the piles rotted; and the wall fell into the sea in many places. Wave action saturated the earth dike behind the stone wall and the ponds of water that formed behind the wall pushed it and the dike into the sea. Immediately behind the main dike is a second dike, this one of earth, which serves as a base for the Hangchow-Shanghai Highway.

Work Divided Into Four Phases

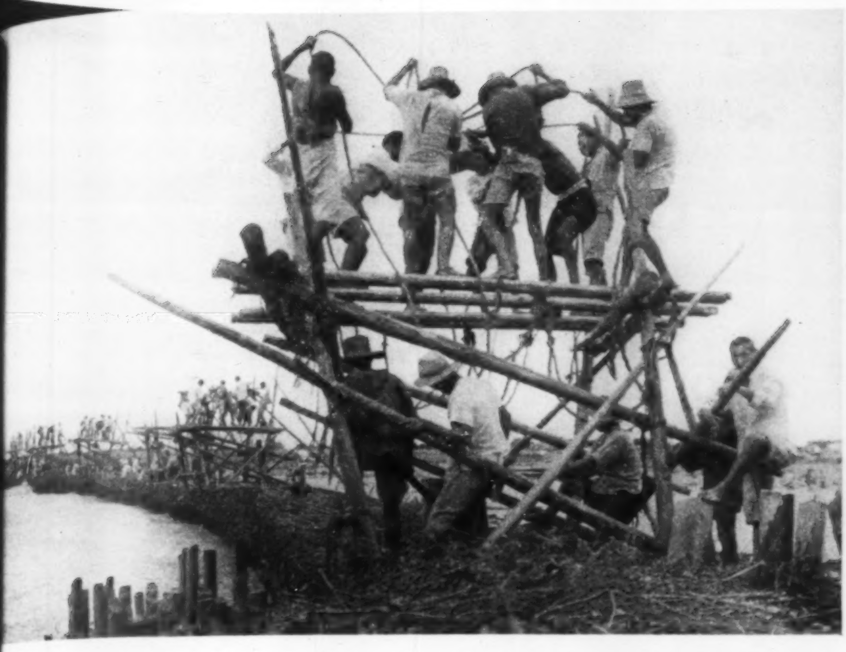
In May 1946 the writer was sent by the United Nations Relief and Rehabilitation Administration in cooperation with the China National Relief and Rehabilitation Administration, from Shanghai to Hangchow to initiate repair of the sea wall. After numerous field trips and studies with Chinese colleagues, he suggested that the work should be done in four phases, as follows:

1. The most pressing need was for the strengthening of existing dikes and the building of temporary brush moon dikes behind the serious breaks. In this phase of the work, which had to be done before the highest tide in September, more than 200,000 cu m of earth and over 2,000 cu m of brush

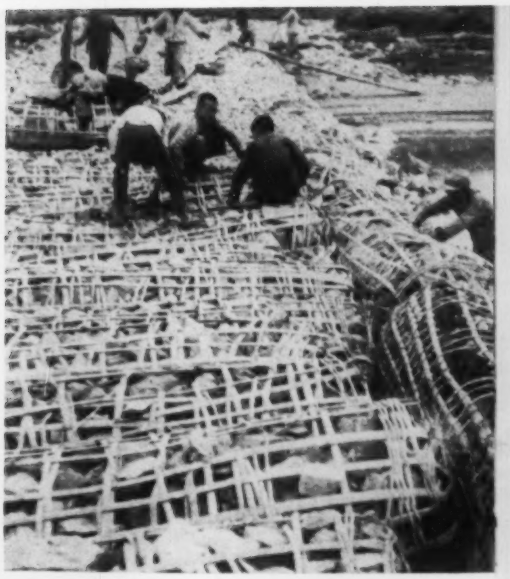
CHIEN TANG DIKE constructed 1,000 years ago is ashlar stone structure 6 m high, 6 m wide at base and 2 m on top. Although protected by heavy riprap, wall is undermined by inrushing tidal waters, exposing pile foundations.



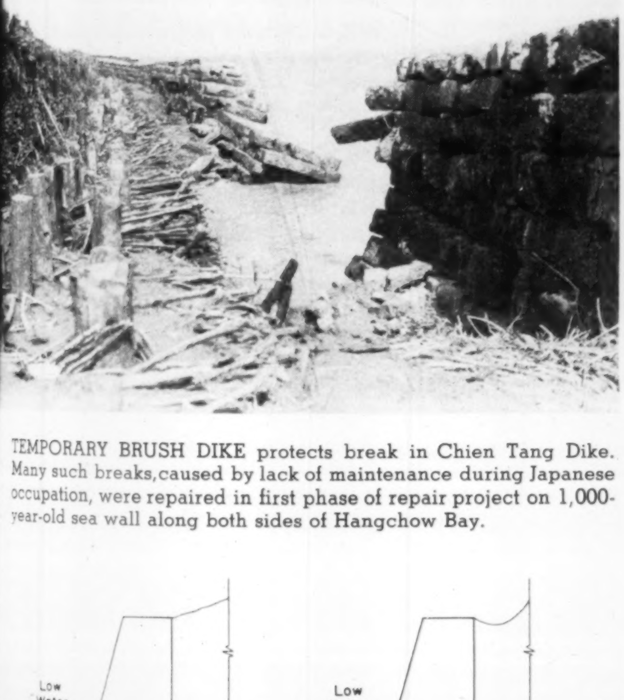
HANGCHOW BORE is result of tide from deep Hangchow Bay water rushing toward mouth of Chien Tang River where large sand bar obstructs movement. Waters "pile up" and are forced over bar into shallow river channel.



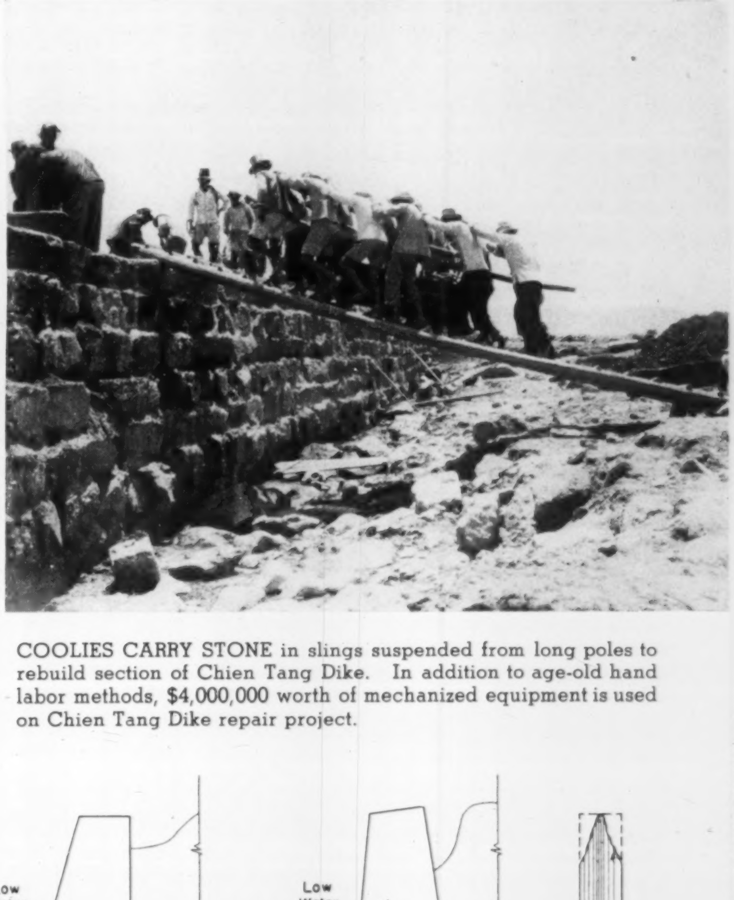
PILEDRIVING GROUP of 15 men using ancient hand methods places 50 to 60 piles per day. Total of 16 such groups rush construction of temporary brush dikes behind serious breaks in existing dikes along Chien Tang River.



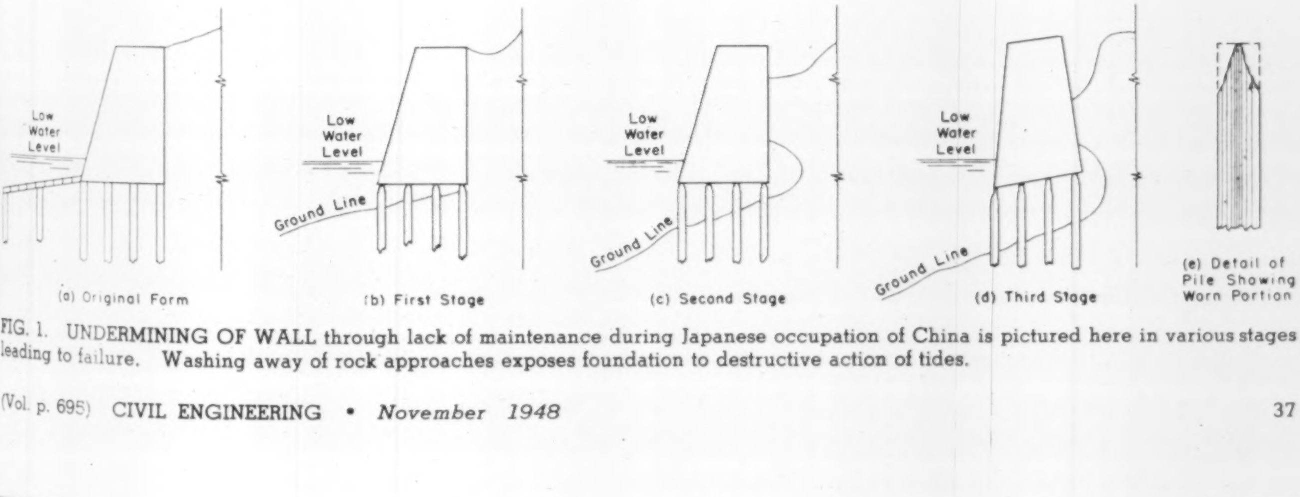
BAMBOO SAUSAGES filled with stone stop erosion caused by wave action from bore and eliminate threat of further damage to Shanghai-Hangchow Highway. More than 80,000 cu m of rock placed in this project is from local quarry.



TEMPORARY BRUSH DIKE protects break in Chien Tang Dike. Many such breaks, caused by lack of maintenance during Japanese occupation, were repaired in first phase of repair project on 1,000-year-old sea wall along both sides of Hangchow Bay.



COOLIES CARRY STONE in slings suspended from long poles to rebuild section of Chien Tang Dike. In addition to age-old hand labor methods, $4,000,000 worth of mechanized equipment is used on Chien Tang Dike repair project.



(a) Original Form

(b) First Stage

(c) Second Stage

(d) Third Stage

(e) Detail of Pile Showing Worn Portion

FIG. 1. UNDERMINING OF WALL through lack of maintenance during Japanese occupation of China is pictured here in various stages leading to failure. Washing away of rock approaches exposes foundation to destructive action of tides.

SIDE-DUMP RAILROAD CARS deliver stone to crusher plant at Chien Shan Quarry, largest and most modern engineering quarry on Chien Tang River. Quarry production rose from 1,350 cu m in December 1947 to 6,000 cu m in June 1948.

dike were constructed. Up to 3,500 workers were employed. At the peak of the work 16 groups were driving from fifty to sixty 20-ft piles per group per day by hand methods. This phase was completed August 22, 1946.

2. The second phase, which started about October 10, 1946, consisted of rebuilding some of the more serious breaks and was limited for budgetary reasons. Mechanics, operators and technicians, as well as engineers were trained on the job site in the use of heavy equipment and modern engineering methods. Two mechanized quarries were opened. UNRRA–CNRRA supplied many units of heavy machinery and construction materials. Extensive experimentation was done on spur dikes. This phase was completed December 1, 1947.

3. Because of the dilapidated condition of the wall, it was an economic impossibility to rebuild and repair all the broken sections. The writer and his Chinese colleagues could see only one solution to the problem of pushing the strong force of the current and water away from the sea wall. The short spurs known as groins constructed in the second phase accumulated silt rapidly. It was therefore decided to build long spur dikes, which will have the following results:

(*a*) The meandering Chien Tang River will be kept in a predetermined course and away from the base of the wall, which will thus become obsolete.

(*b*) The channel will be deepened to allow heavier shipping to come up to Hangchow, which many centuries ago was a port city.

(*c*) A land reclamation program can be initiated which will bring into cultivation more than 300,000 mow (6 mow equals 1 acre) of land. The added protection will increase the economic importance of the triangle formed by Shanghai, Nanking and Hangchow.

4. The fourth phase consists of the final reclamation of all sand banks between the spur dikes—work which will go on concurrently with the third phase.

Silt Deposited in Bay

According to hydraulic reports from the Wangpoo Conservancy Bureau, a great amount of silt from the Yangtsze River is carried by each tide into Hangchow Bay, although the volume of silt in the water is not in excess of 5 percent. The quantity of water is so great that according to estimates each spring tide brings in 630,000 tons of silt and each ebb tide carries out 348,000 tons. This leaves a deposit of 287,000 tons. Spur dikes cause deposition of the silt and the rapid formation of sand banks.

The Chien Tang River originates in the hills of Anhwei province and is fed by many streams from the western mountainous section of Chekiang province. After passing Fu Yang the river enters a more level area and is no longer restricted after it reaches Hangchow.

At Hangchow the river is approximately 1 km in width and at its mouth some 60 km below, it is 15 km wide. It is in the section between Hangchow and its mouth that the river has caused grief for many centuries, swinging back and forth across the plain and causing hardship to all who get in its path. During April 1948 it moved more than a mile in a ten-day period. Erosion is rapid. As the river cuts away one bank it builds up silt on the other bank.

In order to carry out the tremendous construction program needed to return the river to its bed the writer requested and secured large amounts

TUGBOAT "PINE," largest boat ever to enter Chien Tang River, tows wooden barges loaded with stone from quarries at Tang Hill and Goose Hill for spur-dike construction. Previous to project work, river was too shallow to accommodate "Pine's" 9-ft 6-in. draft.

of machinery from UNRRA and CNRRA. Skilled mechanics and technicians from the United States were sent out to train Chinese in the operation of this machinery. It was found that coolies who had aptitude and a desire to learn became the best students while men who were supposedly trained often could not be taught new methods. On-the-job training for over a year and a half has developed a large group of skilled mechanics, jackhammer men and heavy-equipment operators. Prior to the training program, 95 percent of the personnel now employed never had seen heavy construction machinery. These men together with a group of progressive young engineers are carrying forward the offensive on the river regulation program.

On this, the largest equipment-operated conservancy project in China, about $4,000,000 worth of machinery is being utilized, including the following: 60 vehicles, 4 tugboats, 40 wooden barges, 1 steel barge, 5 cranes, 9 bulldozers, 17 air compressors, 5 pony engines, 225 railroad cars, 10 km of railroad, three pile-driving units, a complete repair shop, and other allied construction equipment too numerous to mention.

Two types of spur dikes have been found successful:

1. Brush mattresses, 10×15 m, are built and sunk with stone, which is dumped from barges on to the mattresses to a height of 1 m above mean high water. The spur is capped with bamboo sausages (each holding 5 m of small rock) so that the swift waters will not wash away the top. This type of spur requires approximately 100 cu m of stone to build 1 m of length. This design is being used extensively in the Fourth Pao region.

2. Oregon creosoted piles are driven into the river to form a trestle bridge for the placing of 20-gage railroad track. Stones weighing up to 5 tons are brought to the site by rail and dumped from the trestle. This type of spur is being used on the Haining section. Type 1 construction was not successful in this section as the bore is more destructive and repeatedly carried away all but the largest stones. The piles help to hold the stones in place. After enough stone has been placed, the piles can be removed. About 75 cu m of stone are required for each meter of length gained.

In this work large wooden cribs set on mattresses and filled with stone were also tried. This type of construction was unsuccessful as the unequal erosion under the mattress caused the crib to tilt and then break up. This type of spur dike can be used in shallow water where there is no erosion but not in deep water.

COMPLETE BRUSH MOON DIKE one kilometer long closes large gap in Chien Tang Dike. In first phase of project, which consisted in strengthening of existing dikes and building of temporary brush dikes to close major breaks, more than 200,000 cu m of earth and over 2,000 cu m of brush dike were constructed by labor force numbering up to 3,500 workmen.

Tang Hill Quarry

Tang Hill Quarry on the Chien Tang River upstream of Hangchow was opened on November 4, 1946. The initial load of heavy equipment, Quonset huts, etc., was done at Fourth Pao. (Pao denotes the headquarters of the ancient river dike repair groups, each 1 pao apart, or about 1 km.). Fourth Pao is 5 km below Hangchow while Tang Hill Quarry is located 30 km above Fourth Pao.

The first blast was set off on November 29, 1946, and inaugurated the first machine operation on the Chien Tang River. Because production of stone at the Tang Hill Quarry was not sufficient, a second quarry was opened at Goose Hill about 5 km below Tang Hill. Thereafter production increased from 1,690 cu m during December from Tang Hill quarry alone, to more than 6,000 cu m from both quarries in the month of May. At peak production it is expected that both quarries together can deliver 10,000 cu m monthly.

In December 1946 the Chien Tang River started shifting its course at the bend called Fourth Pao and to date has eroded more than 20,000 mow of land. The Shanghai-Hangchow Highway has been in serious danger and has been damaged severely many times. Severe wave action due to the bore and to the swift waters immediately behind it caused the damage. The bore comes in at an angle of 45 deg to the shore line, bringing waves 25 to 30 ft high which rise into the air and damage houses on the opposite side of the road. Since the start of the work more than 80,000 cu m of rock has been placed. All the stone is quarried at Tang Hill and towed to this point by the fleet of four tugboats and 40 wooden barges.

Because of the destructive force of the water, bamboo sausages filled with stone were used and all spur dikes were capped. The sausages hold the stones in place so that the strong current will not wash stones off the top of the spur. Erosion has stopped from Fourth to Fourteenth Pao (a section of river about 9 miles long below Hangchow). A tremendous amount of effort has been put into spur dike L 52 (at Fourth Pao) which is taking the brunt of the river course and turning it away from the shore line. At the present time the water is 16 m deep at the end of this spur dike. As all spur dikes in this section move forward the river will be moved back into its planned channel. Even now the tugboat *Pine* (draft 9 ft 6 in.), the largest boat that ever entered the Chien Tang River, can tow all barges loaded with stone from the Tang and Goose Hill quarries direct to Fourth Pao. A year ago this was impossible as the river in this section was too shallow.

In the coming year the writer estimates that approximately 100,000 cu m of stone will be quarried and delivered. All the spur dikes will be extended so as to put under control the first concave bend of the river below Hangchow—in the Fourth Pao Section.

With the large amount of vehicles and equipment furnished by UNRRA–CNRRA it was necessary to erect a repair shop and train mechanics and technicians. As Haining is the center of the construction activity, a 40×100-ft Quonset hut was erected for the main building. The shop now has efficient sections for lubrication, tire repair, tinsmithing, battery repair, blacksmithing, parts supply, painting, lathe and repair sections. All major repairs can be done; that is, a vehicle can be completely torn down, rebuilt, painted, and put on the road as good as new.

Because of the bonus plan set up in February 1948, mechanics and technicians have stayed on the job. In former times as men were trained, they left for better jobs. Funds on hand from the China Relief Mission make it possible to purchase spare parts in the open market thus keeping major units in operation.

Just below Hangchow, there are three concave sections in the river as follows:

1. Fourth Pao section, where spur dikes L 47 to L 54 are being built.
2. Tou Ping section, which is held in place by mountains.
3. Haining section, where isolated spurs are being built.

At Mamaokong, the up-river spur dike on the Haining section, only piling and a great quantity of stone can keep the force of the water away from the wall. This spur is the bastion that holds the vast stretch of land between it and Fourth Pao, a section of land 20 miles at the base and more than 10 miles deep. This stretch of land 8 miles below Hangchow, can be developed into rich agricultural land when the Fourth Pao section is brought under control.

Many more spurs must be built in this area to force the river away from the wall and thus build up sand banks. Because of the great distance involved and the lack of rock supply, only isolated spurs are being built.

Hsiang San Spur

The largest and most modern engineering project under way on the Chien Tang River is the building of the Hsiang San Spur. A double-acting 7,700-lb Vulcan piledriver with 45-ft leads, powered by two 315-cfm air compressors, drove 60-ft piles into the river bed.

The piledriving crew, except for the engineer in charge, never saw a piledriver until a year ago when the piledriver was constructed and the coolies trained to be an efficient team. They operate with a minimum of supervision, dismantle and erect the piledriver, operate all types of equipment, and over the past year have driven more than 1,000 creosoted Oregon piles.

In March the piledriving group completed the Hsiang San Spur Dike, driving 400 piles. More than 4,000 cu m of stone was placed at this point, 8 km above Chien Shan. When the piledriving started, one channel of the river was at the base of the wall. In three months' time, a depth of more than 14 ft of silt accumulated at the spur dike and the river channel silted up completely.

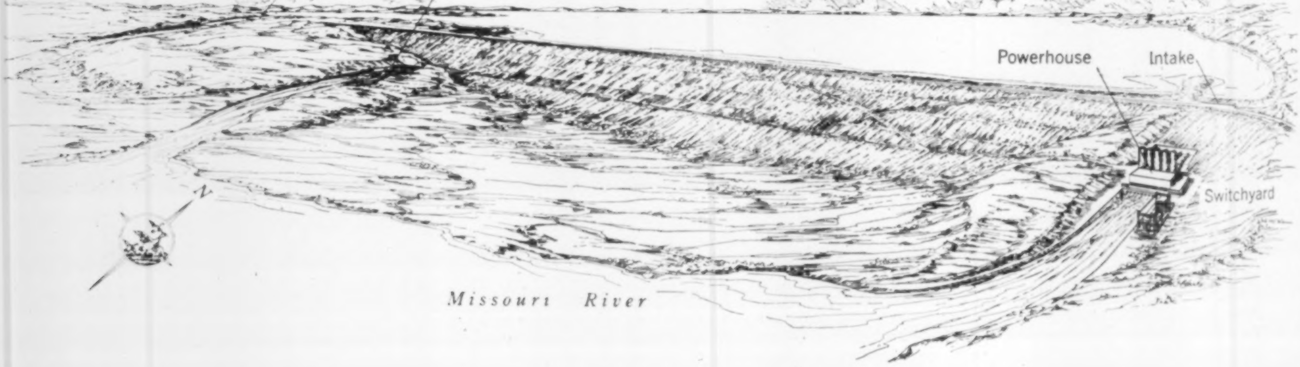
Chien Shan Quarry, set up in June 1947, is 45 miles below Hangchow. Stone from this quarry is delivered by narrow-gage railway to the Hsiang San Spur. Quarry production rose from 1,350 cu m in December 1947 to 6,000 cu m in June 1948.

At Hai Yen, about 60 miles below Hangchow, work is going forward but it is mostly of a maintenance character. A grouting team is filling the voids in the wall and strengthening the base so as to make the wall impermeable. More than eleven separate breaks have been repaired with UNRRA–CNRRA aid in this section. There is no great tidal action here although strong wave action causes damage occasionally. This section of wall is now complete except for routine maintenance.

Probably nowhere else in the world are river control problems as complex as on the Chien Tang River in China. The tidal bore combined with the meandering tendencies of the river has caused engineers grief for centuries. The great amount of data on spur dikes which is being assembled as a result of this work should be helpful in the future to engineers concerned with control work on other rivers. On the Chien Tang, spur dikes to be successful must be deeply rooted and well protected at the base to prevent flanking. The writer will welcome comments from other engineers who have had experience along these lines or who desire more detailed information on the project described here.

Oahe Dam, Third Unit in Pick-Sloan Plan, Placed Under Construction

THIRD MAIN-STEM PROJECT to get under way in Pick-Sloan Plan for development of Missouri River Basin is Oahe Dam, rolled earthfill structure requiring placement of 78,000,000 cu yd of material. Other two dams already started—Fort Randall in South Dakota and Garrison in North Dakota—are in third year of construction. Oahe Dam, here seen in engineer's sketch, has height of 230 ft, crest length of 9,300 ft and serves multiple purposes of flood control, irrigation, power development and recreation. Located on Missouri River about 6 miles northwest of Pierre, S.Dak., structure will form reservoir 250 miles long, extending almost to Bismarck, N.Dak., and having storage capacity of 21,800,000 acre-ft. Tentative schedule provides for employment of 4,000 construction workers at peak and contemplates completion in 1956. Work is under direction of Omaha District Engineer Office, Corps of Engineers, with Col. Louis W. Prentiss, District Engineer, and Lt. Col. Howard A. Morris in charge of Oahe Area office.



Instrument Facilitates Setting of Weir Zero Values

PAUL B. JOHNSON and HERBERT C. STOREY

Formerly Laboratory Assistant, Civilian Public Service, and Geologist, Respectively,
California Forest and Range Experiment Station, Berkeley, Calif.

SETTING AND PERIODIC CHECKING of zero values is an integral part of the measurement of water flowing over weirs. Such flow is computed from the head measured in a still well by a suitable gage. The gage ordinarily gives a gross reading from which an established zero value must be subtracted to give the actual head behind the weir. The instrument described in this paper was designed for rapid and easy determination of the zero value on 90-deg V-notch weirs in the San Dimas Experimental Forest, a branch of the California Forest and Range Experiment Station, which is maintained by the Forest Service, U.S. Department of Agriculture, in coöperation with the University of California, at Berkeley, Calif. (See "The San Dimas Experimental Forest," *Transactions*, American Geophysical Union, Part I, pp. 84–92, 1940.) This instrument is simple to make, rugged, highly accurate, and requires little skill to use.

The instrument (Fig. 1) consists of three plates: Two right-triangular pieces of $^{1}/_{4}$-in. sheet duraluminum and a right-triangular piece of $^{1}/_{16}$-in. transparent plastic such as lucite. One duraluminum triangle is $10^{9}/_{16}$ in. on two sides, and the other is $7^{15}/_{16}$ in. on two sides. Each has a right-triangular hole $4^{1}/_{2}$ in. on two sides, cut out so that the 90-deg angle is centered on the 90-deg angle of the outside of each plate, and the hypotenuse is $^{3}/_{10}$ in. in from the hypotenuse of each plate. The plastic triangular sheet is $7^{5}/_{16}$ in. on two sides.

In assembling, the plastic triangle is placed on the larger duraluminum triangle with the 90-deg angle of the plastic centered with respect to the 90-deg angle of the metal plate, and the hypotenuse of the plastic flush with the hypotenuse of the metal plate. The smaller metal plate is then superimposed on the plastic triangle. The three plates are held together with four machine screws. Strips of soft rubber are glued on the exposed face of the larger triangle outside the edge of the small triangle.

To provide means of clamping the instrument to a V-notch blade, three lugs are attached by means of wing bolts to the smaller metal triangle, one lug located near the bottom of the 90-deg angle and each of the others well up each side. The lugs are long enough to extend out to about $^{1}/_{2}$ in. from the edge of the large triangle. (See Figs. 1, 2, and 3.)

Directly in the center of the exposed part of the plastic triangle is scribed a parallelogram scale, which consists of 11 vertical parallel equidistant lines spaced 0.01 ft apart, and 10 parallel equidistant lines slightly inclined from the horizontal and similarly spaced. The center vertical line bisects the 90-deg angle of the plates. The inclined lines slope so that a horizontal line through the right end of one line will pass through the left end of the next line above. Each line is numbered as in Fig. 1. The lines are scribed on the back of the plate and the numbers on the front. The left end of the bottom line marked 0.30 is exactly 0.30 ft above the 90-deg "V" formed by the outside edge of the smaller metal plate. Each inclined line is 0.010 ft above the one below.

During measurement, the water is diverted around the weir box, which is drained until the water level is between 0.3 and 0.4 ft above the bottom of the V-notch. The instrument is placed in the V-notch with the larger metal plate against the upstream face of the weir and the outside edge of the smaller metal plate resting in the V-notch of the weir. The wing bolts are tightened, forcing the lugs against the downstream side of the weir blade.

The water level in the weir box can now be read directly on the parallelogram scale in the same way that a chemical graduate is read. Figure 3 shows the instrument in place and being read. The level is read on the left scale. For example, suppose the dashed line through the parallelogram in Fig. 1 were the observed water level. It falls between 0.34 and 0.35. The dashed line crosses the inclined line where it is cut by the vertical line labeled "3." The complete reading is then 0.343.

Since the edge of the small metal plate fits snugly in the weir, the illustrated depth above the bottom of the V-notch is 0.343 ft. The zero value is obtained by subtracting 0.343 from the gross reading on the still-well gage. Several independent zero readings are made to be sure the water

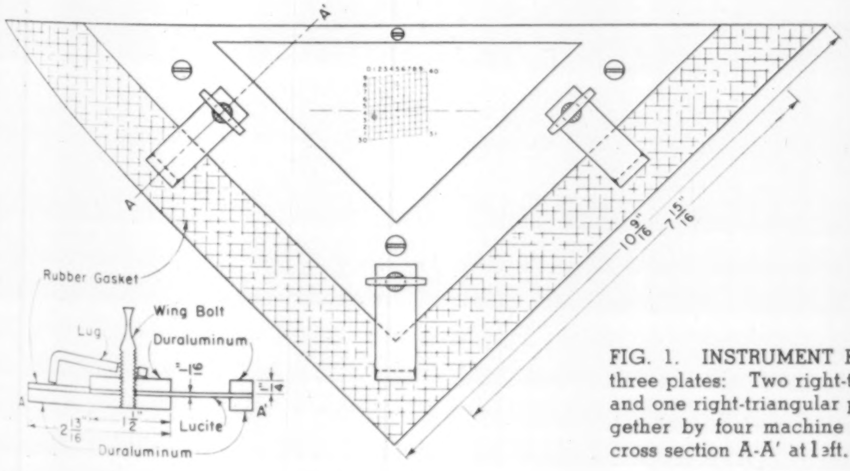


FIG. 1. INSTRUMENT FOR CHECKING weir zero values consists of three plates: Two right-triangular pieces of $^{1}/_{4}$-in. sheet duraluminum and one right-triangular piece of $^{1}/_{16}$-in. transparent plastic, all held together by four machine screws. Method of assembly is indicated by cross section A-A' at left.

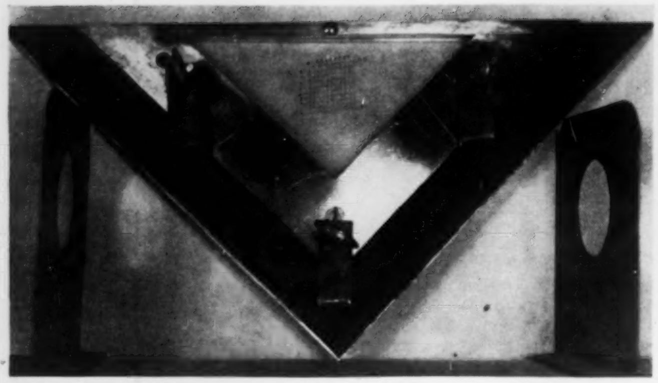


FIG. 2. ASSEMBLED INSTRUMENT for checking weir zero value has outside measurement of $10^9/_{16}$ in. on each arm of right triangle. Three lugs held by wing bolts are conveniently placed to provide means of holding instrument in place in V-notch weir to be tested. See Fig. 3, in which wing bolts have been tightened to clamp lugs to edge of weir.

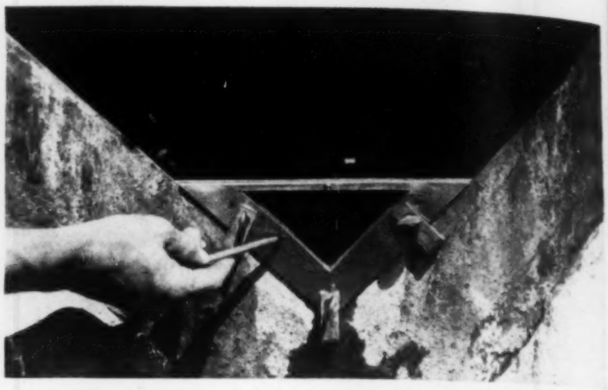


FIG. 3. INSTRUMENT INSTALLED in 90-deg V-notch weir provides simple means of checking zero value. Water is diverted around weir box to draw level down to between 0.3 and 0.4 ft above bottom of V-notch of instrument. Water line is opposite pencil. Water level in weir box is read directly on parallelogram scale on plastic triangle. See Fig. 1.

level in the still well and weir box is not changing. When the level is stabilized, different zero readings should not vary more than 0.001 ft. The average after stabilization is the true zero. A pinch of fine dust is sometimes dropped on the surface to make the water surface more distinct. Light falling on the floating dust particles is scattered at the water level, making a sharp line clearly distinct from the meniscus.

Design of Steel-Lined Concrete Pressure Conduits

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IN CONNECTION with the design of hydroelectric power plants, an interesting problem is presented by a steel conduit subjected to internal pressure and surrounded by massive reinforced concrete, by plain concrete, or by concrete and rock. As shown in Fig. 1, the composite section (*a*) is made up of a steel liner (*b*), and a concrete cylinder (*c*). The steel liner is subjected to the bursting internal pressure P_1 and the restraining outside pressure of concrete P_2. The difference between these pressures $(P_1 - P_2)$ is resisted by the tension in the steel shell. The unit pressure P_2, which is external with respect to the steel liner, is internal with respect to the surrounding concrete, and is induced by the expansion of the steel cylinder under the internal pressure P_1. The stress values in the concrete and steel are explained in the following paragraphs.

Stress and Strain Relationship

Consider the concrete or rock in Fig. 1 (*c*) as a thick-walled cylinder subjected to internal pressure only, which in this case is designated P_2. Designate the radial stress at any point as σr, the hoop or tangential stress as σt, and the shearing stress as J. Then

$$\sigma r = P_2 \frac{a^2}{b^2 - a^2}\left(1 - \frac{b^2}{r^2}\right) \quad (1)^1$$

$$\sigma t = P_2 \frac{a^2}{b^2 - a^2}\left(1 + \frac{b^2}{r^2}\right) \quad . \quad . \quad (2)$$

$$J = \frac{\sigma t - \sigma r}{2} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (3)$$

Considering the thickness of the steel liner t as negligible, the radial displacement, u, at the inner surface of the concrete cylinder shown in Fig. 1 (*c*), due to internal pressure P_2, is given by the formula,

$$u = P_2 \frac{a}{E_c}\left(\frac{a^2 + b^2}{b^2 - a^2} + \mu\right) . \quad (4)$$

The elongation of the circumference of the steel liner ΔC can be expressed in terms of the radial displacement of concrete,

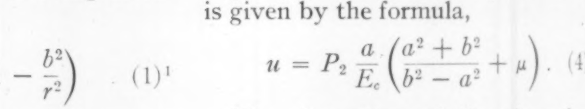
$$\Delta c = 2\pi(a + u) - 2\pi a = 2\pi u \quad (5)$$

Expressing the stress in the steel liner in terms of the concrete displacement u and in terms of the effective pressure on the liner $(P_1 - P_2)$ and equating the two expressions,

$$E_s \frac{u}{a} = \frac{(P_1 - P_2)a}{t} \quad . \quad . \quad . \quad . \quad (6)$$

Substituting the value of u from Eq. 4 and solving for P_2,

FIG. 1. STEEL-LINED CONCRETE PRESSURE CONDUIT (a), composed of steel liner (b) and concrete shell (c), is subjected to internal pressure P_1, most of which is transmitted to surrounding concrete as P_2.



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[1] The initial solution for thick-walled cylinders was made in France by Lamé and Clapeyron about 1833. Equations 1, 2 and 3 can be verified by reference to any standard text on the advanced mechanics of materials.

TABLE I. COMPUTATIONS FOR EQUATION 7

$\frac{b}{a}$	$\frac{a^2 + b^2}{b^2 - a^2}$	$\frac{P_2}{P_1}$
1.0	∞	0
1.1	10.52	0.56
1.2	5.54	0.70
1.3	3.90	0.76
1.4	3.08	0.80
1.5	2.60	0.83
2	1.67	0.88
5	1.08	0.91
10	1.02	0.92
∞	1.00	0.92

$$P_2 = \frac{P_1}{1 + \frac{t}{a} n \left(\frac{a^2 + b^2}{b^2 - a^2} + \mu \right)} \quad . \; . \; (7)$$

in which n is the ratio of the modulus of elasticity in steel to the modulus of elasticity in concrete or rock, and μ is Poisson's ratio for concrete or rock.

Significance of Formulas

Equation 7, giving the value of the pressure transmitted to the concrete, is of the greatest interest to the designer. Assuming that the ratio of the thickness of plate to the radius $t/a = 0.005$, that $E_s/E_c = n = 15$, and that $\mu = 0.020$, and assigning different values to b, the results shown in Table I are computed.

From Table I it is seen that the stress transmitted to the concrete envelope rapidly increases in value from 0 to about 90 percent of P_1 as the concrete thickness increases from 0 to the value of the inside radius ($b = 2a$). Beyond this point the value of the transmitted pressure for all practical purposes may be considered as constant. When the value of b is very large compared to a, the ratio $\frac{a^2 + b^2}{b^2 - a^2}$ approaches 1.0 as a limit and Eq. 7 becomes

$$P_2 = \frac{P_1}{1 + \frac{t}{a} n(1 + \mu)} \quad . \; . \; (8)$$

Thickness t has small effect on the transmitted pressure P_2 for large values of b/a, as shown in Table II, computed from Equation 8.

For thin concrete shells, the effect of increasing t to reduce the transmitted pressure P_2 is more pronounced. The hoop stress in the concrete envelope expressed by Eq. 2 has the highest value at the inner surface where,

$$\sigma t_{\max} = \frac{P_2(a^2 + b^2)}{b^2 - a^2} \quad . \; . \; . \; (9)$$

This value is always greater than the bursting pressure P_2 and approaches the value of P_2 as b becomes greater. The radial stress also has its maximum at the inner face of the concrete, where it equals the internal pressure P_2. The minimum value of P_2 at the outside periphery equals zero.

The maximum shear at the inner face is

$$J_{\max} = P_2 \frac{b^2}{b^2 - a^2} \quad . \; . \; (10)$$

in which $J_{\max}$ approaches the internal pressure as b increases.

The application of the theory to practical problems of design generally falls into two groups. Group 1 includes those cases in which the outside concrete or concrete and rock are of sufficient strength to withstand the internal pressure. In such cases the steel plate should be made as thin as possible to save material. The steel plate will act principally as a watertight membrane guarding against a rupture, which could be caused by percolating water building up high pressure under a joint or a construction plane. Where the designed conduit is to be located below a considerable depth of rock, the concrete and rock around the steel liner may be permitted to crack if the tangential unit stress exceeds the tensile strength of the concrete. Then the weight of the cracked portion of rock above the conduit will counteract the internal pressure and keep the structure in equilibrium. In other cases cracking of the rock and concrete cannot be permitted and reinforcing steel should be provided to resist the hoop tension.

A pressure outlet through a concrete dam presents a more complicated problem because of the internal stresses in the concrete. The most economical solution of this problem would be to design the steel conduit to satisfy the minimum thickness requirement and provide sufficient reinforcement around the opening to take care of the hoop stress from the bursting pressure and to resist the tensile stresses caused by the opening under the imposed dam and reservoir loadings.

TABLE II. COMPUTATIONS FOR EQUATION 8

For $\mu = 0.2$, n 15, $b \gg a$

t/a	P_2/P_1
0.001	0.98
0.002	0.96
0.005	0.92
0.010	0.85
0.015	0.79
0.020	0.74

To Group 2 belong those cases in which the steel conduit is designed to withstand the full hydrostatic internal pressure. In such cases it is not desirable to transmit any of the pressure to the surrounding concrete. To avoid transmission of pressure several methods can be used. Layers of expansion-joint materials of sufficient thickness, such as lightweight cork boards or felt dipped in asphalt, can be placed around the steel conduit before the concrete is placed. When the steel conduit expands under internal pressure, the displacement will be absorbed by the filler material so that no pressure will be transmitted to the concrete shell.

Another method would be to pump up the pressure inside the steel conduit to its maximum intensity prior to concreting. For higher values of internal pressure, say those greater than 75 psi, it is advisable to place a layer of mastic with burlap around the steel conduit to prevent bond. A concrete shell made in this manner will not be subject to internal pressure when the steel conduit is in operation.

Before making the actual design in each case, a careful study of the probable physical conditions will be necessary for the most economical installation in accordance with the principles stated herein.

Work Progresses on 13,000,000-Cu Yd Earthfill Harlan County Dam

FOUR-YEAR PROJECT for construction of Harlan County (Nebraska) Dam and Reservoir, involving 16,000,000 cu yd of excavation and placing of 13,000,000 cu yd in rolled-fill embankment, is expedited by arrival of heavy equipment at site. In photo, two International TD-24 tractors tow Bucyrus-Erie crane from railway siding into working position.

INTERNATIONAL DIESEL

Social Order Influences
Methods Used in Exlpoiting India's Water Resources

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Minneapolis, Minn.

IN HIS PAPER, "An Appraisal of India's Water Resources," presented before the Annual Convention of the Minnesota Federation of Engineering Societies, Dr. Straub discussed the effect of the internal problems of India and Pakistan, the great difference in the social order in these countries as compared with that in the United States and their influence on the nations' technological development. The influence of social order on details of procedure and on techniques followed in the exploitation of natural resources—particularly water—is reviewed in the following excerpts from Dr. Straub's paper. Other items on the development of India's water resources appear in the August 1948 issue of CIVIL ENGINEERING (page 33) and the June 1947 issue (page 69).

INDIA HAS repeatedly impressed the writer as a land of great extremes. In this respect, the distribution of precipitation over the country's vast area is no exception. In the desert area of the northwestern province of Sind, the rainfall averages about 2 to 4 in. per year, a precipitation rate not greatly different from that in our own southwestern Mojave Desert area; on the other hand, at the southern tip of India some localities have a recorded annual precipitation exceeding 500 in., that is, more than 40 ft. Compare this to the mean annual precipitation of about 2 ft in the Minneapolis–St. Paul area.

In northern India the great rivers which carry the runoff from both the northern and southern slopes of the Himalayas provide great quantities of water which can be used to irrigate the extensive fertile plains south of these mountains. Further south on the great plateau of the Indian peninsula it might be said that during the rainy season it is too wet to raise crops, and during the dry season there is no water for this purpose. But the deep passes carved into the great plateau land provide many excellent sites for dams to develop hydroelectric power and storage reservoirs for irrigation and multiple-purpose projects.

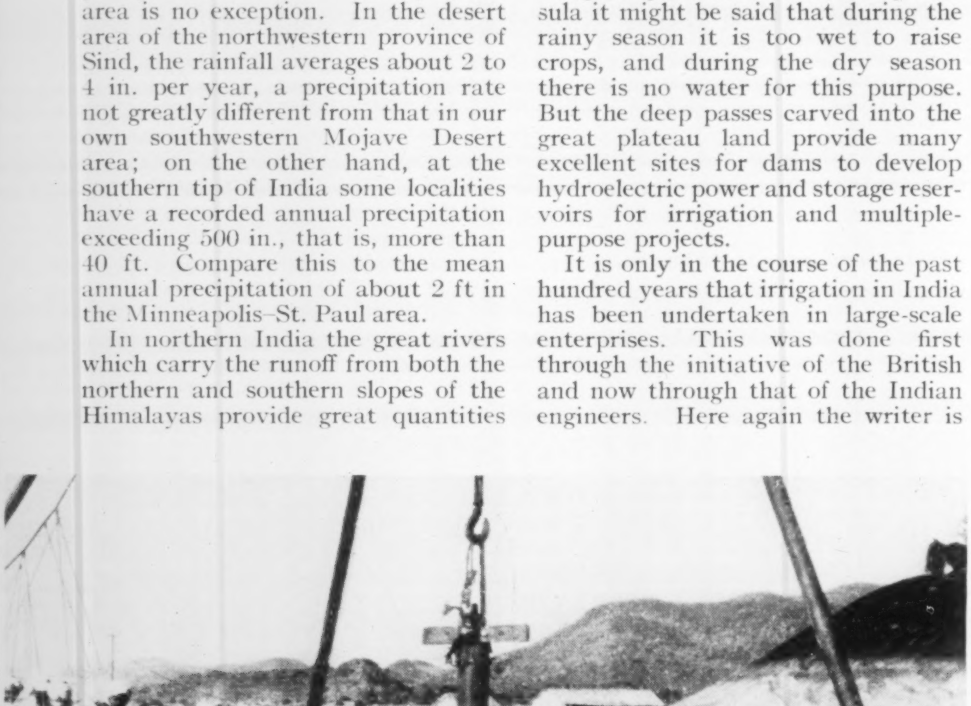
It is only in the course of the past hundred years that irrigation in India has been undertaken in large-scale enterprises. This was done first through the initiative of the British and now through that of the Indian engineers. Here again the writer is reminded of the great extremes in modern Indian enterprise. In travelling through the highly developed irrigation province of the Punjab one is impressed by the sight of many well installations motivated by a bullock-team treadmill, each pumping possibly as much as 1 cfs, but in other places one sees excellently engineered irrigation head controls on large rivers, supplying large offtake canals with rates of flow in the millions of gallons per minute.

The Ramapadasagar Project with which the writer is concerned, involving irrigation in the Madras area by means of a huge dam and diversion works from the Godavari River, is estimated to cost 850 million rupees or about 275 million dollars and will provide two-crop irrigation for more than twice the acreage to be served by the great Grand Coulee Dam in the State of Washington.

Large Hydroelectric Developments

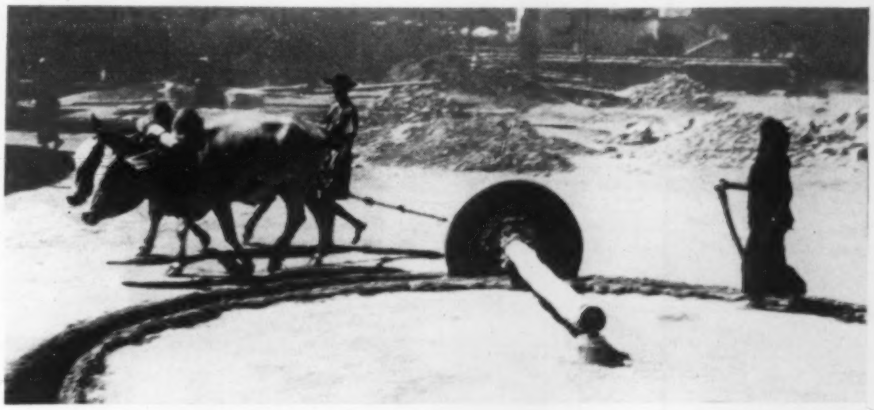
India has a considerable number of hydroelectric developments and is now making plans for as many more such developments as the requirements demand. Some of these are quite large, but not as compared to the huge hydroelectric plants of this country. Hydroelectric installations with an output of 200,000 kw are considered quite large in India. The turbines, generators, and control mechanisms are usually purchased from either England or the United States, so that in general no singular differences from our installations are to be expected.

The ever-increasing demand for food production has resulted in the continual expansion of irrigation, and design features unique to India have evolved. India has some 70 million acres under irrigation as compared to about 21 million acres in the United States. Yet in India the adequacy of the water supply is not as serious a problem as it is in this country where



HAND-POWERED PILEDRIVER is used in making penetrometer tests at Ramapadasagar damsite. Dozen coolies pull ropes attached to hoisting cable to lift drop-weight for driving force.

BULLOCK TEAM POWERS TYPICAL MORTAR MIXING PLANT (right) for construction of brick masonry apartment houses in city of Bangalore. Trough of annular ring form receives sand and cement mixtures. Large stone disk wheel is normally pulled 100 cycles through annular ring, mixing mortar as it passes. Women hod-carriers use saucer-shaped baskets supported on their heads for transporting mortar to bricklayers.



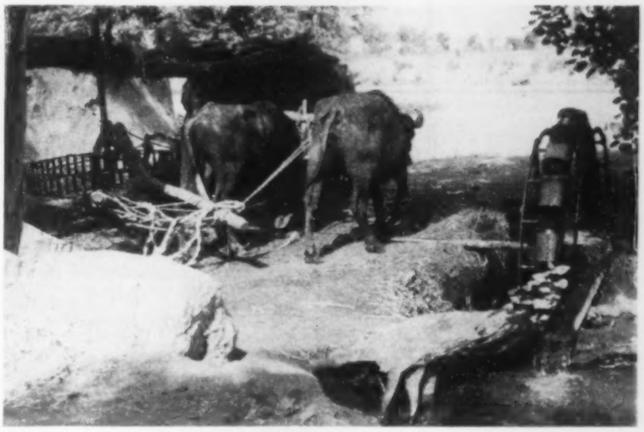
in some parts of the Southwest more irrigation channels have been provided than there is water available to supply from the headworks of the river. It is estimated that only about 3 percent of India's water resources have thus far been exploited. The great water supply from snow sources in the Himalaya Mountains of northern India and the enormous precipitation brought about by the southwest monsoons over the Indian plateau area are a great asset to this corner of the world.

Construction Procedures Differ

Types of structures and construction procedures used in India differ widely from those in our own country. The differences are attributable to the great divergence between the social orders and economic levels in the two countries. Moreover, up to the present time the individual provinces have had direct control over the development of their respective water resources and the accumulation of know-how has tended to be a provincial acquisition without the nationwide distribution of information that we find in the United States, where most of the great water problems are handled by federal agencies.

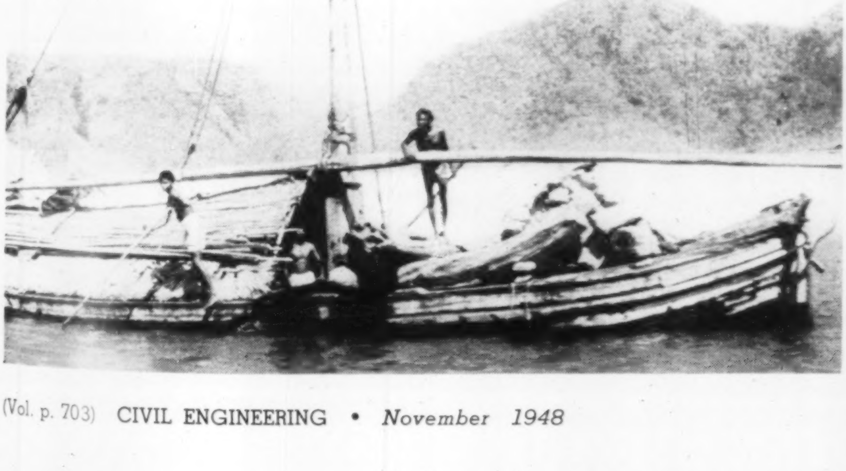
Apropos of construction types and methods, one might well start with a consideration of the wage level and the cost of living. It cost the writer approximately the same amount to live in India as it does in America at an equivalent level, in so far as that level was available—which it usually was not except in the largest metropolitan centers. On the other hand, while serious misgivings are expressed by some of the managing personnel on the great wage increase for labor of over 300 percent since the World War, the cost of labor is still low indeed. In southern India the laborer on heavy construction work earns about one rupee a day. At an exchange rate of about 3 rupees to the dollar, this rate amounts to about $2.00 per 6-day week. It is little wonder that, even from a purely economic point of view, hand labor is used to an extent which to the American would appear a scandalous waste of manpower.

BUCKET-TYPE wheel or chain pump (right) for raising water to higher level is operated by buffalo team traveling in circular path. Scene, common in northern India, marks contrast with excellently engineered irrigation projects found in other localities.



Large amounts of cheap labor are not conducive to the development of concrete structures, which by their very nature are best built by highly mechanized construction equipment. Labor-saving equipment has been the exception in India. In fact, even gasoline-operated lorries for moving earth long distances for use in embankments is a quite recent development, stimulated in part by the availability of free equipment left in India by the American overseas military forces. At the port of Madras the writer observed hundreds of American trucks stored in the open which, he was told, the government was trying to give back to the United States because of the high cost of gasoline to operate the vehicles. Only jeeps and other smaller vehicles were considered within their economic means to operate.

A typical example of the use of labor was on a hydroelectric con-



DEVELOPMENT OF GODAVARI RIVER by construction of huge Ramapadasagar Dam in Madras area will provide two-crop irrigation for one million acres of farm land. Boat and crew pictured here are typical of transportation facilities which are available on Godavari River.

ECONOMIC CONDITIONS IN INDIA and customs developed over many centuries dictate use of methods unfamiliar to Western eyes. Parcels are balanced on head or carried on stick as shown in view.

LAWN SPRINKLER SYSTEM used in the Punjab consists of goat skin filled at central point and slung over shoulder of laborer who controls spray by hand. Pressure is increased by elbow and forearm.

struction project visited at Job Falls in the state of Mysore, where the writer found 2,000 workers engaged on the construction of the masonry shell and adjoining structures for a power plant, and 3,000 working on a combination earth embankment and masonry dam, the embankment containing about 500,000 cu yd of earth and the stone masonry dam possibly 100,000 cu yd. In the United States, very few workmen would be seen around a job of this sort.

Unusual Contractual Procedures

Contractual relationships also are usually quite different from those in the United States. Three procedures are identifiable. The one most frequently used by the government is force-account employment, which is thought most economical and effective because it enables the government engineers to gain the continual experience required for improvements in subsequent undertakings. According to this system, the contractors supply day labor, while the government issues materials which it has purchased from materials dealers and passed on to the contractors. Thus the government can control the quality of the material put into a structure. The contractor usually provides labor services for masonry construction on a yardage charge basis.

In the second method the contractor supplies both labor and materials. On one large undertaking, a combination of the two methods was used in that the contractor supplied the stone for the masonry, but the government supplied materials for the mortar. The object was to assure adequate richness in the mix to provide a good structure. It is not unusual for several masonry contractors to be employed on a single job.

The third procedure is similar to that used in the United States, in which construction schedules are announced and bids are awarded to contractors for the construction of various parts of the work. This is the normal procedure where large-scale operations are involved demanding mechanization of construction operations. Undoubtedly the 275-million-dollar Ramapadasagar Dam and Irrigation Works with which the writer has been associated will be handled by contract according to the normal American procedure. Actually the Indian government engineers recognize that a project of this magnitude can be built only with the most modern of American methods using labor-saving machinery of large size. Even so, the construction period will extend over about eight years.

Total Costs Are Close to Ours

In reviewing the cost of construction for large projects in India, it is to be noted that, despite the low rate of pay of about $2.00 a week (of six days) for common labor and up to about $4.00 a week for skilled tradespeople, total costs are significantly close to ours. Thus for an embankment of about 500,000 cu yd, constructed by hand methods, the unit cost was about 40 cents per cu yd of material in place. Over 1,000 people were engaged in the operation, and there was no mechanized equipment except for one sheepsfoot roller. A dam of stone masonry construction about 150 ft high varied in cost from about $4.00 per cu yd near the base to a maximum of about $9.00 per cu yd near the crest, and the reinforced concrete in the spillways cost $55.00 per cu yd.

In this country the cost of the earth embankment would have been about the same in similar surroundings; the cost of mass concrete here would exceed the average in India by about 50 percent; and the cost of reinforced concrete here would be less than in India. Thus, the cost of masonry construction in India is rapidly approaching the cost of mass concrete in the United States. The Indians will eventually adopt mechanized methods for large projects, with a further advance in labor costs. However, this development may be some years, possibly some generations, in the future, considering the great surplus of Indian labor.

TOOLS USED to implement well-drilling operations at Ramapadasagar damsite are displayed by group of workers on large irrigation and hydroelectric project. Dam will be second largest in world, furnishing more power than that needed to supply combined needs of Minneapolis and St. Paul.

Engineers' Notebook

Formulas Simplify Design of Concrete Columns Under Axial Load and Skew Bending

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DESIGN OF REINFORCED concrete columns in space frameworks, such as are found in building frames, four-legged supports for refinery vessels, and numerous other supports for heavy industrial equipment, raises the problem of proportioning a column for axial load and skew bending. By skew bending is meant the moment M, which is the resultant of two moments, M_1 and M_2, acting at some angle to each other. The column in such case receives its greatest stress in a corner. Since the resistance of the concrete corner is surprisingly small, the compressive steel is of utmost importance. A simple set of formulas covering this particular case is presented. The derivation is for axial compression and bending, with tension over part of the section.

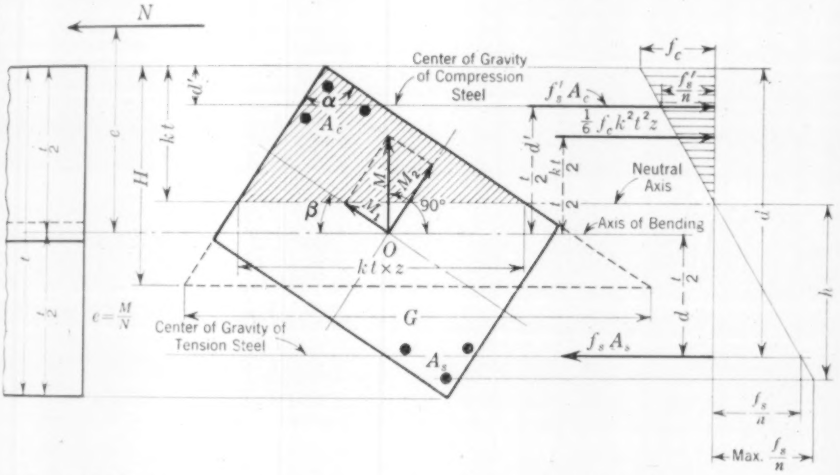
N
Center of Gravity of Compression Steel
f_c
$f'_s A_c$
$\frac{f'_s}{n}$
$\frac{1}{6} f_c k^2 t^2 z$
d'
α
A_c
kt
c
H
$\frac{t}{2}$
t
M
M_1
M_2
$90°$
β
$t-d'$
$\frac{kt}{2}$
Neutral Axis
Axis of Bending
O
$kt \times z$
$d-\frac{t}{2}$
d
h
$e=\frac{M}{N}$
G
Center of Gravity of Tension Steel
A_s
$f_s A_s$
$\frac{f_s}{n}$
Max. $\frac{f_s}{n}$

FIG. 1. **CROSS SECTION of rectangular reinforced concrete column shows stresses under axial compression and bending, with tension over part of section. Only steel in north and south corners is considered. Steel in east and west corners is inconsequential.**

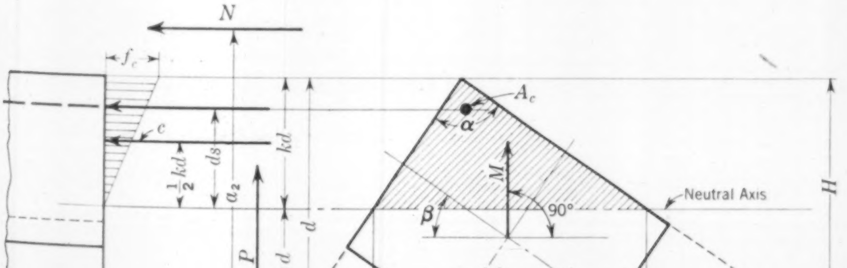
N
f_c
c
$\frac{1}{2} kd$
ds
a_2
kd
d
P
$(1-k)\,d$
$A_s f_s$
a_1
A_c
α
M
β
$90°$
Neutral Axis
$kd \times z$
G
A_s
H

FIG. 2. **CROSS SECTION shows rectangular reinforced concrete column subject to bending moment M and axial compression N, in which M is moment of transverse as well as axial forces in tensile steel.**

Figure 1 shows the column section and stress diagram. All symbols are conventional. Only the steel in north and south corners is considered; steel in east and west corners is inconsequential. An expression for the triangular area in compression is obtained from the ratio $z = G/H$, where G is the base and H the height of any triangle whose two sides are formed by the column section. When $\alpha = 90$ deg, $z = (\tan\beta + \cot\beta)$.

By proportion,

$$f_s' = nf_c\left(1 - \frac{d'}{kt}\right) \quad . \; . \; . \quad (1)$$

$$f_s = nf_c\left(\frac{d}{kt} - 1\right) \quad . \; . \; . \quad (2)$$

Also max $f_s = f_s \dfrac{h}{d - kt}$

Projecting the forces on a horizontal axis,

$$N = {}^1/_6 f_c k^2 t^2 z + f_s' A_c - f_s A_s$$

Substituting Eqs. 1 and 2 and reducing,

$$N = \frac{f_c}{kt}\left[{}^1/_6\, t^3 z k^3 + nt(A_c + A_s)k - n(A_c d' + A_s d)\right]$$

Inserting the following short terms:

$(A_c + A_s) = A_T$; $(A_c d' + A_s d) = C_1$; and $(A_c d'^2 + A_s d^2) = C_2$,

the equation becomes

$$N = \frac{f_c}{kt}\left({}^1/_6\, t^3 z k^3 + ntA_T k - nC_1\right) \quad . \; . \; . \quad (3)$$

Taking moments of the forces about the center of the section,

$$M = {}^1/_6 f_c k^2 t^2 z\left(\frac{t}{2} - \frac{kt}{2}\right) + f'_s A_c\left(\frac{t}{2} - d'\right) + f_s A_s\left(d - \frac{t}{2}\right)$$

Substituting Eqs. 1 and 2 in the above,

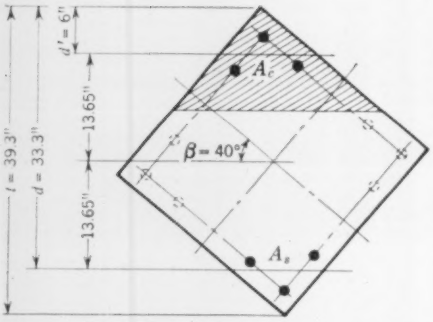

FIG. 3. USE OF FORMULAS in analyzing 28-in. square column illustrates rational set-up outlined in text.

$$M = {}^1/_6 f_c k^2 t^2 z \left(\frac{t}{2} - \frac{kt}{2}\right) + nA_c f_c \left(1 - \frac{d'}{kt}\right)\left(\frac{t}{2} - d'\right) + nA_s f_c \left(\frac{d}{kt} - 1\right)\left(d - \frac{t}{2}\right)$$

Reducing and substituting the terms A_T, C_1, and C_2, the equation becomes

$$M = \frac{f_c}{kt}[-{}^1/_{12}\, t^4 z k^4 + {}^1/_{12}\, t^4 z k^3 + nt\,({}^1/_2 A_T t - C_1)k + n(C_2 - {}^1/_2\, C_1 t)] \quad . . (4)$$

Remembering that $e = M/N$, we may combine Eqs. 3 and 4 into the single equation,

$$\begin{aligned}{}^1/_{12}\, t^4 z k^4 + {}^1/_6\, t^3 z(e - {}^1/_2 t)k^3 + \\ nt[A_T(e - {}^1/_2\, t) + C_1]k - \\ n[C_1(e - {}^1/_2\, t) + C_2] = 0 \quad . . . (5)\end{aligned}$$

When investigating an existing section, substitute all known quantities in Eq. 5 and solve for k. Next, substitute the now known value of k in Eq. 3 and solve for f_c. Then find f_s' and f_s by Eqs. 1 and 2, respectively. The equations hold true with or without compression steel.

If e is small, and the neutral axis falls appreciably below the east and west corners of the column section, the formulas are no longer exact. However, the concrete stress near the neutral axis is not of noticeable value. Moreover, the steel in the east and west corners is beneficial in resisting stresses although it has been neglected in the formulas.

If N is a tensile instead of a compressive force, Eq. 5 becomes

$$\begin{aligned}{}^1/_{12}\, t^4 z k^4 - {}^1/_6\, t^3 z(e + {}^1/_2\, t)k^3 - \\ nt[A_T(e + {}^1/_2\, t) - C_1]k + \\ n[C_1(e + {}^1/_2\, t) - C_2] = 0\end{aligned}$$

and Eq. 3 then reads

$$N = \frac{f_c}{kt}(-{}^1/_6\, t^3 z k^3 - ntA_T k + nC_1)$$

The steel areas may be predetermined with fair accuracy along the lines suggested for an ordinary concrete section by C. L. Christensen (*Engineering News-Record*, July 26, 1928, page 127). Figure 2 shows a rectangular column section subject to bending moment M and axial compression N. In this case M is the moment of the transverse as well as the axial forces with respect to the tensile steel, namely, $M = Pa_1 + Na_2$. As before, for any angle α, $z = G/H$. For $\alpha = 90$ deg, $z =$ (tan β + cot β); ratio $R = \frac{d_s}{kd'}$; $C = {}^1/_6 f_c k^2 d^2 z$.

Without compressive steel the section will resist a moment m determined by a tensile steel area of

$$A_1 \times f_s = {}^1/_6 f_c \times k^2 \times d^2 \times z;$$

or

$$A_1 = \frac{f_c k^2 d^2 z}{6 f_s};$$

and $\quad m = A_1 f_s \times (1 - 0.45\, k) \times d.$

The value of j apparently should have been $1 - 0.5\, k$, but $1 - 0.45\, k$ gives closer average results.

To resist the remainder of the total moment M, additional steel areas must be furnished at the centers of tension and compression. The additional tensile reinforcement is

$$A_2 = A_1 \times \frac{M - m}{m}.$$

The final tensile steel area is

$$A_s = A_1 + A_2 - \frac{N}{f_s}$$

The compressive steel area becomes

$$A_c = A_2 \times \frac{f_s}{Rf_c n}$$

When the single bar in each corner of the column is replaced by groups of bars (as in Figs. 1 and 3), A_s must be increased by 30 percent, and A_c must be decreased by 15 percent if the above formulas are to yield usable results in all average cases.

To illustrate the rational set-up made possible by the foregoing analyses, the use of the formulas will be shown in analyzing a 28-in. square column. The section in question is to resist a bending moment of M = 900,000 in.-lb acting under an angle β = 40 deg and a simultaneous axial compressive force N = 40,000 lb. Modular ratio n = 15. Allowable stresses f_c = 600 psi, and f_s = 16,000 psi. With these stresses, k = 0.36. The column section appears in Fig. 3.

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1. Predetermination of Steel Areas

$kd = 0.36 \times 33.3 = 12$ in. Then ratio $R = \frac{d_s}{kd} = \frac{6}{12} = 0.50$

$$\begin{aligned}\tan 40 \text{ deg} &= 0.84 \\ \cot 40 \text{ deg} &= 1.19 \\ z &= 2.03\end{aligned}$$

$$\text{Now } A_1 = \frac{600 \times 0.36^2 \times 33.3^2 \times 2.03}{6 \times 16{,}000} = 1.82 \text{ sq in.}$$

$$\text{and } m = 1.82 \times 16{,}000\,(1 - 0.45 \times 0.36) \times 33.3 = 813{,}000 \text{ in.-lb}$$

$$M = 900{,}000 + 40{,}000 \times 13.65 = 1{,}446{,}000 \text{ in.-lb}$$

$$A_2 = 1.82 \times \frac{1{,}446{,}000 - 813{,}000}{813{,}000} = 1.42 \text{ sq in}$$

$$A_s = 1.82 + 1.42 - \frac{40{,}000}{16{,}000} = 0.74 \text{ sq. in.}$$

$$A_c = 1.42 \times \frac{16{,}000}{0.5 \times 600 \times 15} = 5.06 \text{ sq in.}$$

However, since groups rather than single bars are used in the corners of the column, we have

Final $A_s = 0.74 \times 1.30 = 0.96$ sq in.,
Final $A_c = 5.06 \times 0.85 = 4.30$ sq in.

2. Check of Steel Areas by Exact Method

$$\begin{array}{llll} A_c = 4.30 \text{ sq in.} \times & 6 = 25.8 \times & 6 = 155 & e = \frac{\text{M}}{\text{N}} = \frac{900{,}000}{40{,}000} = 22.5 \text{ in.} \\ A_s = \underline{0.96} \text{ sq in.} \times 33.3 & = \underline{32.0} \times 33.3 & = \underline{1{,}063} & \\ A_T = 5.26 \text{ sq in.} & C_1 = 57.8 & C_2 = 1{,}218 & (e - {}^1/_2\, t) = 2.85 \text{ in.} \end{array}$$

Substituting the known quantities in Eq. 5, $k = 0.33$. Inserting this value of k in Eq. 3,

$$f_c = 580 \text{ psi}$$

Equations 1 and 2 now give,

$$f_s' = 4{,}700 \text{ psi and } f_s = 13{,}600 \text{ psi}$$

By ratio,

$$\max f_s = 13{,}600 \times \frac{23.0}{20.3} = 15{,}400 \text{ psi}$$

Check on Above Stresses

$$\begin{array}{rrrr} {}^1/_6 f_c k^2 t^2 z = {}^1/_6 \times 580 \times 0.33^2 \times 39.3^2 \times 2.03 = & +33{,}200 \text{ lb} & \times 13.15 = & +437{,}000 \text{ in.-lb} \\ f_s' A_c = \quad 4{,}700 \times 4.30 = & \underline{+20{,}200 \text{ lb}} & \times 13.65 = & +276{,}000 \text{ in.-lb} \\ & +53{,}400 \text{ lb} & & \\ f_s A_s = \quad 13{,}600 \times 0.96 = & \underline{-13{,}100 \text{ lb}} & \times 13.65 = & \underline{+179{,}000 \text{ in.-lb}} \\ N = & 40{,}300 \text{ lb} & M = & 892{,}000 \text{ in.-lb} \end{array}$$

SOCIETY NEWS

Outstanding Program Is Presented at ASCE Fall Meeting

Members Join with Boston Society of Civil Engineers in Centennial Celebration

A WELL-ROUNDED PROGRAM of technical and social events, presented under the sponsorship of the Northeastern Section, attracted over 900 engineers and their families to the Fall Meeting of the Society in Boston. Ten sessions of nine ASCE Technical Divisions constituted the technical program, presented on Wednesday and Thursday, October 13 and 14.

Participating were the City Planning and Highway Divisions, which met jointly; the Sanitary Engineering Division, which held a joint session with the Boston Society of Civil Engineers; and the Construction, Power, Air Transport, Structural, Surveying and Mapping, and Soil Mechanics and Foundations Divisions. Write-ups of the Technical Division sessions appear on pages 17 to 23.

Engineers Urged to Plan

Citing the role of the profession in present-day defense activities, at the opening session on Wednesday morning, Leonard Carmichael, president of Tufts College, warned the group that, "The time to plan for possible periods of great emergency is when full catastrophe is not upon us. Here and there one meets men who say that America should not plan at the present time for possible war. It is hard to agree with such individuals."

Stating that "the experiences of the second World War showed that civil engineering was in many respects the most basic of all engineering fields," Mr. Carmichael commented on the many problems that "can be studied in the relative calm of today. As engineers," he continued, "I am sure you will approve of the preparation of blueprints before the building starts to rise. Some plans that may never be needed are comforting to have on the shelf in periods during which one crisis succeeds another. I hope that my mention of these essentially gloomy problems will not make you believe that I am pessimistic about the future of America. The opposite is the case. I feel confident that an alert America can avert the encroaching catastrophe of a third World War. But I am equally sure if we are to avoid this cataclysm we must plan wisely now."

Advocates Longer Professional Training

In a talk entitled "A Scientist Looks at Engineering," presented at the same session, George R. Harrison, dean of science at Massachusetts Institute of Technology, advocated lengthening the period of college training for the engineering student to enable him to strive for high professional status in his own field and, at the same time, keep up with the progress of science as it affects his field. "I feel that what civil engineering needs most now is conscious realization of the need for greatly increased numbers of young men with seven years of college training," he stated.

Pointing out that research laboratories in the fields of chemical, electrical, and mechanical engineering are receiving active support from commercial firms with allied interests, Dean Harrison asked, "Where are the corresponding laboratories of civil engineering? A few university laboratories are forward-looking in this regard, but unless I am seriously misinformed, the total expenditure for research and development in civil engineering, except by government, is minuscule compared with that in other fields of engineering or science."

Other speakers at the Wednesday

EXECUTIVE COMMITTEE IN CHARGE OF ARRANGEMENTS FOR ASCE BOSTON MEETING (left, photo) includes, left to right, seated: Miles N. Clair, president, Northeastern Section, Mrs. Charles B. Breed, chairman, Ladies' Committee on Arrangements, Harrison P. Eddy, Jr., general chairman, and ASCE Director Albert Haertlein; standing, Fred H. Paulson, Providence, Frank A. Marston, Prof. Emil A. Gramstorff, Howard M. Turner, and Ralph W. Horne. In picture of Ladies Executive Committee are, left to right, seated: Mrs. J. B. Wilbur, Mrs. Charles B. Breed, Mrs. Charles M. Spofford, and Mrs. Ralph W. Horne; standing, Mrs. Albert Haertlein, Mrs. Miles N. Clair, and Mrs. Howard M. Turner.

morning session were Miles N. Clair, president of the Northeastern Section of the Society; W. H. Buracker, Commissioner of Public Works, Boston; and John J. Mahoney, Public Buildings Commissioner, of Boston. All gave speeches of welcome, and President R. E. Dougherty responded in behalf of the visiting Society members.

Officers Address Local Groups

As part of the Society's public relations program, ASCE officers were invited to address Boston civic organizations and luncheon groups during the meeting week. These speakers included Vice-Presidents Gail Hathaway and Carlton Proctor and Director Webster L. Benham.

In addition, a large audience was reached by radio programs that disseminated information on professional and technical activities and on the role of the civil engineer in society. One of these radio programs, heard over Station WEEI, consisted of a symposium on "The Engineer in War and Peace," and talks on "Traffic Congestion" were broadcast over Stations WCOP and WBZ. The latter subject is of special local interest, as Boston now has under consideration a Master Plan for Highways (August issue, page 75), which was discussed at the Wednesday afternoon joint session of the City Planning and Highway Divisions.

Joint Social Activities

Mutual ties between America's two oldest engineering societies—the Boston Society of Civil Engineers and the ASCE—were discussed at the general membership luncheon on Wednesday noon by John R. Babcock, 3rd, professor of railroad engineering at Massachusetts Institute of Technology. Other social activities included the usual Wednesday evening dinner dance and a buffet and smoker on Thursday evening, to which the ladies were invited. An informal program, consisting of a talk by James J. Britt, radio sports announcer, on his experiences in broadcasting, was enjoyed on the latter occasion.

Special entertainment for the ladies of the party included a tour of the Fogg Museum and a tea on Wednesday, and an all-day excursion on Thursday to Concord and Lexington, with a stop for luncheon at the Colonial Inn in Concord. The Women's Committee on Arrangements was headed by Mrs. Charles B. Breed as chairman, and Mrs. Harrison P. Eddy, Sr., and Mrs. F. E. Winsor as honorary chairmen.

Friday Inspection Trips

Friday was devoted to a wide variety of tours to points of engineering and historic interest in the Boston area. Under the sponsorship of the Soil Mechanics and Foundations Division, an early morning trip was made to the Soil Mechanics Laboratories at Massachusetts Institute of Technology and Harvard University. The same group, in cooperation with the Air Transport Division, sponsored an afternoon tour of the Watertown Arsenal Soils Laboratory. Other special tours included a boat trip around Boston Harbor, under the auspices of the Waterways Division, which afforded an opportunity for inspection of waterfront installations.

Throughout the day buses left the Statler for other points of interest in the metropolitan area, including the Boston Airport and Navy Drydock. A late-morning tour of the North Shore had as its objective the Gloucester Tavern and a New England shore dinner.

PICTURED IN LADIES' RECEPTION AND INFORMATION COMMITTEE for Fall Meeting o Society are, left to right, front row: Mrs. Herman Protze, Mrs. F. M. Gunby, Mrs. Alber Haertlein, chairman, Mrs. W. F. Uhl, and Mrs. Emil Gramstorff; rear row, Mrs. O. G Julian, Mrs. T. R. Camp, Mrs. Frederick W. Weaver, Mrs. H. P. Burden, Mrs. Arthur L Shaw, Mrs. Gordon M. Fair, and Mrs. H. M. Westergaard. Committee members not show are Mrs. E. F. Littleton, Mrs. J. E. McKee, and Mrs. M. A. Reidy.

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Actions of Board of Direction, ASCE Fall Meeting

Boston Mass., October 11 and 12

1949 Budget

The principal concern of the Board of Direction at the Boston Meeting was the adoption of a budget for the fiscal year 1949 in the face of the stringent financial limitations imposed upon the Society because of the refusal on the part of the members at large, to provide additional Society income through a raise in dues.

The Board adopted, with a few minor changes, the budget submitted by the Budget Committee. The Board adhered to the policy of a balanced budget, a firm position taken at Jacksonville in October 1947. The 1949 budget, as adopted by the Board, is on the basis of an estimated income of $724,150 and estimated operating expenses of $722,050, leaving a net estimated surplus, or contingency fund for unanticipated expenditures during the year, in the amount of $2,100. The Budget Committee commended the Executive Secretary and his staff for the close control of expenditures exercised during 1948.

"Voluntary Fund"

Because of the financial situation, it was decided that the "Voluntary Fund" be continued and that our Life Members, about 2,000, be so advised, as well as others who might desire to make direct contributions to the Society.

Glossary of Water and Sewage Terms

Arrangements were made for the early printing of the long awaited *Glossary of Water and Sewage Works Terms.* Because of the size and cost of this volume, it was decided that it will be made available to the members of the Society at the approximate cost of printing and mailing.

Local Section Allotments

The Board was forced to hold to its present formula in connection with Local Section allotments, that is, $50 plus $1 fo

Each dues-paying member of each Local Section. However, the travel allowance for Local Section representatives attending Local Section Conferences was restored to the full mileage allowance instead of half the allowance as was the case during the past year.

Executive Committee Appointments

Appointments to the Executive Committees of the City Planning, Highway, Hydraulics, Sanitary, and Soil Mechanics Divisions were made by the Board of Direction in July 1948 and announced in the August issue of CIVIL ENGINEERING. Recommendations by the Division Activities Committee were approved covering appointments to the Executive Committees of the following Divisions:

October 1948 Appointments

Air Transport .	H. H. Howell, Kansas City, Mo.
Construction .	A. H. Ayers, San Francisco, Calif.
Irrigation . .	G. S. Knapp, Topeka, Kans.
Power	Milton G. Salzman, New York, N.Y.
Surveying and Mapping . .	W. H. Rayner, Urbana, Ill.
Structural . .	Raymond Archibald, Washington, D.C.
Waterways . .	W. O. Hiltabidle, Jr., Washington, D.C.

All of these appointments become effective in January 1949. An additional appointment to the Executive Committee of the Waterways Division was made naming Glen E. Edgerton, Washington, D.C., to fill out the unexpired term of Charles B. Burdick, resigned from the Executive Committee.

1950 Meetings of Board of Direction

The Board approved the calendar for the 1950 meetings of the Board of Direction as follows:

New York, N.Y., January 19–21
Los Angeles, Calif., April 19–21
Toronto, Canada, July 12–14
Chicago, Ill., October 11–13

The Summer Convention in Toronto in July will be a joint meeting with the Engineering Institute of Canada.

Committee on Military Affairs

The Committee on Military Affairs reported that an all-day conference has been arranged with Army authorities in Washington for November 29 and also advised the Board of an Army "orientation tour" covering Washington, D.C., Pensacola and Orlando, Fla., and return to Washington. President Dougherty and Vice-President Proctor stated that they expect to accept the Army invitation for the "orientation tour" and to attend as much of it as their time permits.

Committee on Publications

The Committee on Publications reported that the present stringency of Society funds and the exceptional increases in publishing costs forced the Committee to accept a reduced number of papers for PROCEEDINGS. Since PROCEEDINGS discussions heretofore have in large measure been completely unrestricted and occupy approximately one-half of each issue of PROCEEDINGS, ways and means are being sought by the Publications Committee to reduce the volume of discussions through giving discussions much the same type of test and screening as is given the original papers.

Manual on Hydrology

Possibilities of producing a Manual on Hydrology during the coming year, without providing in the budget for the cost of producing such a manual, were explored. Opinion was offered that a Manual on Hydrology might be produced on a self-liquidating basis, and further investigations along these lines were discussed with a view to the possibility of printing the manual this year.

Revision of Constitution

Consideration by the Board of Direction covering a draft of proposed revisions to the Society's Constitution and tentative plans for re-districting resulted in the discontinuance for the present of the study of these matters within the fixed limits of our present organization plan. Before proceeding further in these considerations, it was decided that a special committee be appointed to study and report on the organizational patterns of societies similar to ours, with a view to a possible modernization of our present Constitution to meet the complex needs of our present large and widespread membership. The President named, and the Board appointed, Arthur W. Harrington of Albany, N. Y., chairman of this Committee, Executive Secretary W. N. Carey, and two members from each of the four Zones—namely,

Zone I, Carlton S. Proctor and Charles B. Breed
Zone II, E. M. Hastings and Joel D. Justin
Zone III, W. W. Horner and W. L. Benham
Zone IV, John W. Cunningham and C. Glenn Cappel

Recommendations of Prize Committees

The Board approved recommendations by several prize and award committees:

J. C. Stevens Award to Preston T. Bennett, with second order of merit to Carl E. Kindsvater.
Rudolph Hering Medal to C. E. Jacob.
Norman Medal to Alfred Freudenthal.
J. James R. Croes Medal to Karl de Vries.
Thomas Fitch Rowland Prize jointly to M. M. Fitz Hugh, J. S. Miller and Karl Terzaghi.
James Laurie Prize to Hyde Forbes.
Arthur M. Wellington Prize to Joseph Barnett.
Collingwood Prize for Juniors to John K. Vennard.
Leon S. Moisseiff Award to George Winter.
Construction Engineering Prize to C. Glenn Cappel.

Elections to Honorary Membership

The following members were elected to Honorary Membership: Charles H. Buford, Lucius D. Clay, Donald Derickson, Gano Dunn, and Andrew Weiss.

Committee Appointments

Appointments to miscellaneous committees were made as follows:

Joint Cooperative Committee, AGC-ASCE: E. A. Prentis, Chairman, Gail A. Hathaway and E. L. Macdonald.

Committee on National Affairs: Charles H. Purcell was added to the Committee already composed of I.V.A. Huie, Chairman, Robert B. Brooks and William D. Shannon.

EJC Committee on Cancer Research: Thorndike Saville as ASCE representative, vice Morrough P. O'Brien.

ASA Sectional Committee A-58: Clyde T. Morris, Frank A. Randall and Maurice N. Quade. James L. Edwards already is an ASCE representative on this committee and the additional three members now enlarge the ASCE representation.

ECPD Appointments: Frank C. Tolles as an ASCE representative on the Council to succeed Scott B. Lilly, deceased.

ECPD Committees on Student Selection and Guidance, Engineering Schools and Professional Recognition: R. M. Green, H. T. Heald, and F. J. Lewis, respectively.

ECPD Committee on Professional Training: Jacob E. Warnock.

Engineering Societies Library Board

The Board of Direction concurred in the recent revisions of United Engineering Trustees By-Laws concerning the Engineering Societies Library Board. These By-Laws reduce the number of participating society representatives on the Library Board to two for each society. The Board retained as ASCE representatives, Harold M. Lewis, now a member of the Library Board Executive Committee, and W. N. Carey.

Bidding for Engineering Services

The matter of public bodies calling for bids for professional engineering services again came before the Board for discussion. It was decided that the present Committee on Public Engineering Practice and Policy should be temporarily increased by three men in specially adapted fields for the purpose of attempting to develop a procedure whereby improvements can be made in the manner of selecting engineers in private practice by agencies of government, both local and federal.

Report of Delegate to European Conferences

A report was received from Prof. Mario G. Salvadori relative to his attendance as a delegate of ASCE and Columbia University to the recent centenary meeting of the Society of Civil Engineers of France and the VII International Congress of Applied Mechanics in London. Prof. Salvadori reported that the level of discussions and the quality of papers were exceptionally high and that an atmosphere of friendliness prevailed at all meetings. He also stated that the VIII International Congress of Applied Mechanics will be held in 1952 at Istanbul, Turkey.

Report on London Conference

Executive Secretary Carey reported on the conference in London, October 4 to 8, 1948, attended by representatives of the engineering institutions of the following countries: Belgium, Denmark, France, Holland, Norway, Sweden, Switzerland, and Great Britain. The United States was represented through EJC, ASCE, and ASME. E. E. Howard, of Kansas City, Mo., personally represented President R. E. Dougherty. Executive Secretary W. N. Carey and Secretary C. E. Davies were representatives, respectively, of ASCE and ASME and representatives jointly of Engineers Joint Council. The conference considered questions concerned with the operation and policies of the participating institutions, and how, by developing more intimate collaboration and an exchange of facilities and information, they could more effectively accomplish the purposes for which they were founded. All representatives present were the guests of the engineering institutions of Great Britain—namely, the Institution of Civil Engineers, the Institution of Mechanical Engineers, and the Institution of Electrical Engineers.

ASCE Ruled Educational Organization

The Board received a report from the Executive Secretary regarding a reversal of a ruling made by the Internal Revenue Bureau in January 1948. The January ruling changed the status of the Society from one operated exclusively for educational and scientific purposes to the general classification of trade organizations and chambers of commerce. Under such a ruling, contributions to the Society were not deductible for the purpose of taxation under the Income Tax law. The January ruling was successfully contested and revoked by the Internal Revenue Bureau at Washington under date of July 27, 1948. The Society is now firmly recognized under income-tax law as being operated exclusively for educational and scientific purposes.

Engineering Representation in Government and World Affairs Discussed at EJC Meeting

AMONG MATTERS OF professional concern discussed at a recent regular meeting of Engineers Joint Council in New York, was the subject of obtaining appropriate engineering representation in the Executive Branch of the Federal Government. The suggestion was advanced that such representation might take the form of a new Cabinet post or that, by stipulation, one of the six confidential advisers to the President be an engineer. Another proposal advocated steps toward obtaining suitable representation in the proposed Department of Works, which will be included in recommendations of the Hoover Commission on Organization of the Executive Branch of the Government.

To implement these suggestions, the National Engineers Committee, Consultative to Federal Authorities, was directed to discuss the matter with Herbert Hoover, Hon. M. ASCE, and with Robert Moses, chairman of the Task Force of the Hoover Commission, to which has been delegated the preparation of recommendations regarding a Department of Works.

Reporting in behalf of the National Engineers Committee, E. G. Bailey, president of ASME, discussed activities of the committee in connection with the program of the Economic Cooperation Administration in Europe. The committee has held meetings and, at different times, has discussed with Secretary of State Marshall, ECA Administrator Paul G. Hoffman and other officials the possibility of EJC assistance in the European Recovery Program, Mr. Bailey stated. The committee has also given the ECA considerable assistance in getting suitable personnel for phases of its work requiring the services of engineers.

To handle problems of technologic personnel outside the scope of the Selective Service Committee, the Council voted to reinstate the Committee on Technologic Personnel in relation to National Security as a subcommittee under the National Engineers Committee. This committee was authorized to appoint a task committee to deal with all matters concerning the engineering branches of the unified military services and to act on invitation from the Department of the Army for consultative advice and studies. A member of the present ASCE Committee on Military Affairs is to be included on the task committee to coordinate the work of the Committee on Technological Personnel with the work already accomplished by the ASCE Committee on Military Affairs.

Brazilian Engineers Entertained by EJC

REPRESENTATIVES OF ENGINEERS Joint Council and officers and staff members of its constituent societies were host to a group of 30 Brazilian engineers at a recent meeting and cocktail party at the Engineers Club in New York. The South American visitors—headed by Argemiro Conte de Barros, president of the Engineers Institute of São Paulo, and Armando de A. Pereira, president of the Manufacturers Association of São Paulo—were welcomed by Dr. L. W. Bass, EJC chairman.

In responding for the Brazilian engineers, Mr. Pereira spoke of the First Congress of the Union of Pan American Engineers, to be held in Rio de Janeiro in July 1949, and expressed the hope that many engineers from the United States would attend the congress and present papers. He also read a letter written by Thomas Jefferson to Louis XIV of France in 1787, in which Jefferson spoke of the need for a strong and friendly Brazil, and gave a copy of the letter to Dr. Bass.

PICTURED AT EJC RECEPTION for Brazilian engineers at Engineers Club in New York are (left to right) Gen. Stewart E. Reimel, secretary of EJC Committee on International Relations; Armando de A. Pereira, president of Manufacturers Association of São Paulo; Argemiro Conte de Barros, president of Engineers Institute of São Paulo; and L. W. Bass, EJC chairman.

Further Economies Instituted to Balance Budget as Dues Increase Is Voted Down

A BALANCED BUDGET, in which operating expenses are estimated slightly below anticipated income, was adopted by the ASCE Board of Direction at its Fall Meeting in Boston, Mass., October 11–12, in the face of stringent financial limitations imposed by defeat of the constitutional amendment to increase dues.

Failure of the dues increase amendment to pass accentuated the need for the policy of a balanced budget which the Board adopted a year ago at its Fall Meeting in Jacksonville. Expenditures for 1948 were kept within the authorized budget. For the fiscal year of 1949, income is estimated at $724,150 and operating expenses are expected to be $722,050, leaving a contingency fund for unanticipated expenditures during the year in the amount of $2,100.

Ballots cast on the proposed constitutional amendment to increase dues, and on a second amendment to eliminate the $5 differential now paid annually by members residing in District 1, were counted at a meeting of the Society on October 1. Both amendments failed to obtain the necessary two-thirds majority, and neither becomes effective. A total of 9,620 votes was cast on the question of increasing Society dues. Of this number, 5,898 members voted for, and 3,722 voted against the increase. The total vote cast represents 40 percent of the eligible voters within the Society, as against a ballot by 46.5 percent of those eligible to vote on the same amendment a year ago, before Juniors were enfranchised. The 5,898 who favored the dues increase constitute about 25 percent of the eligible voters, and the 3,722 who registered opposition to the increase, about 15 percent.

The vote by Districts on both constitutional amendments is given in Table I.

TABLE I. VOTE ON CONSTITUTIONAL AMENDMENTS BY DISTRICT

	Constitution Amendment No. 1 Increase in Society Dues			Constitution Amendment No. 2 Equalization of Dues		
District	Votes for	Votes Against	Votes Cast	Votes for	Votes Against	Votes Cast
No. 1 (Except foreign)	982	409	1,391	1,078	293	1,371
2	326	193	519	222	264	486
3	201	102	303	139	151	290
4	226	154	380	187	167	354
5	213	180	393	169	199	368
6	325	250	575	235	310	545
7	304	218	522	211	281	492
8	317	199	516	219	271	490
9	378	211	589	286	274	560
10	370	246	616	258	332	590
11	426	323	749	323	396	719
12	308	159	467	210	239	449
13	462	381	843	347	453	800
14	270	166	436	197	208	405
15	373	255	628	305	309	614
16	326	248	574	195	355	550
Foreign	91	28	119	53	57	110
Total	5,898	3,722	9,620	4,634	4,559	9,193

Reductions in the 1949 budget, as adopted, follow the policy outlined by the Board at its Spring Meeting in Pittsburgh last April (see CIVIL ENGINEERING for May 1948, page 60).

As a result of the limitations imposed by rejection of the proposal to provide additional Society income through a raise in dues, the 1949 budget provides exactly half the amount necessary for operation of the Society's regional offices in Washington, D.C., Chicago, Ill., and Los Angeles, Calif. This reduction, the Budget Committee pointed out, will permit orderly rearrangement of the activities carried on by these offices. It is likely that the Mid-West and Western Offices can not be operated, as such, for more than a very brief portion of the fiscal year. The Board proposes to retain the Washington office on a reduced scale, but in a manner which will continue to protect ASCE interest in national affairs.

Allotments to Local Sections remain about as last year. The allotment formula then used was not changed: $50 for each Section plus $1 for each member paying Local Section dues. Travel allowance for Local Section representatives attending Local Section conferences was restored to the full mileage allowance, instead of half the allowance to which it was reduced a year ago.

In the face of continuing price increases, particularly in the field of technical publications, the largest single item of expenditure in the Society's operations, it is anticipated that changes will be made in the Society's publications policy as the year progresses. A special committee studying technical publications is expected to have a final report covering this matter at the Board meeting in January.

The Board decided not to publish a complete Yearbook for 1949, but to reduce the appropriation of $30,000 for this item by half and provide the membership with a reduced yearbook, possibly in the form of a listing of corrections and additions to the 1947 Yearbook as published.

It was suggested, in connection with printing of future manuals, that the Board authorize use of moneys in the Voluntary Fund as a revolving fund, to finance such publication during the interval between printing of the publications and the reimbursement through payment for the publications by ASCE members and others who purchase them.

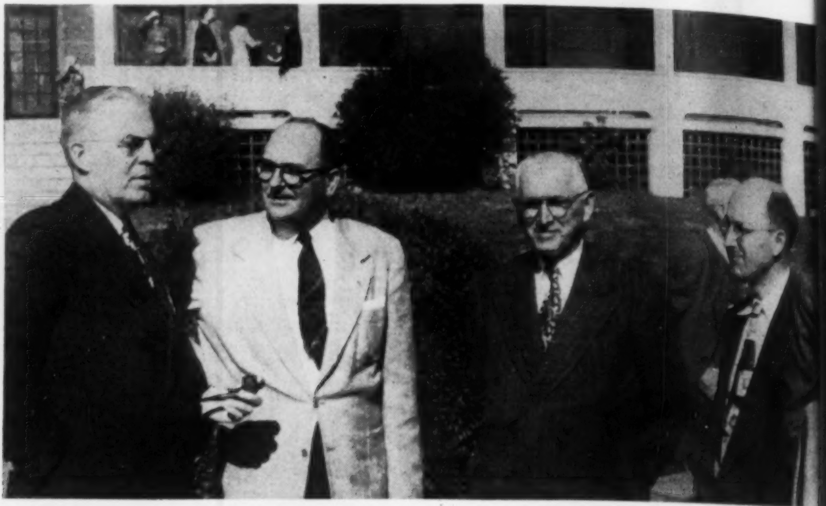
In discussions regarding the Summer Convention of the Society in Mexico City next July, it was emphasized that the cost to the Society would be no greater—and perhaps even less—than if the meeting were held in the United States, since traveling expenses of Board members will be paid only to the nearest regular port of entry into Mexico.

Spokane Section to Have Branch at Richland, Wash.

A RICHLAND BRANCH of the Spokane Section—authorized by the Section's Board of Directors to accommodate an influx of engineers into the area for the construction operations of the new Engineer District at Walla Walla—was established at a recent inaugural meeting. An attendance of 40 included ASCE Western Representative Walter E. Jessup, who spoke briefly. Plans were made to alternate monthly meetings between Richland and Walla Walla, with the next meeting scheduled for Walla Walla.

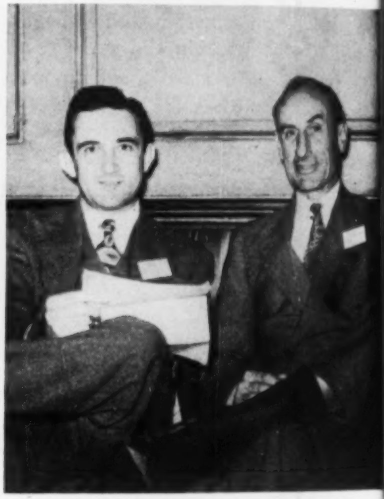
Officers of the new Branch are: H. L. Friend, president; Francis A. Torkelson, vice-president; and M. H. Russ, secretary-treasurer.

TWO MEMBERS OF NORTHEASTERN SECTION, Arthur L. Shaw and Karl R. Kennison, enjoy Gloucester sunshine during recent ASCE Fall Meeting excursion there.



ASCE FALL MEETING VISITORS TO GLOUCESTER are welcomed to that famous fishing village by Mayor Weston B. Friend (third from left). With Mayor Friend are, left to right, Executive Secretary W. N. Carey, M. W. Campbell, and Miles N. Clair, president of ho Section and member of executive committee in charge of meeting.

PAST-PRESIDENT E. M. HASTINGS (center) discusses his recent trip to China as member of special ECA survey mission with, left to right, Col. James H. Stratton and Frank A. Marston, Bostonians, and Society Directors David L. Erickson of Lincoln, Nebr., and Webster L. Benham, of Oklahoma City, Okla.



HARRISON P. EDDY, JR., Fall Meeting chairman (right), gives advice on running meetings to David Benham, chairman of forthcoming Spring Meeting.

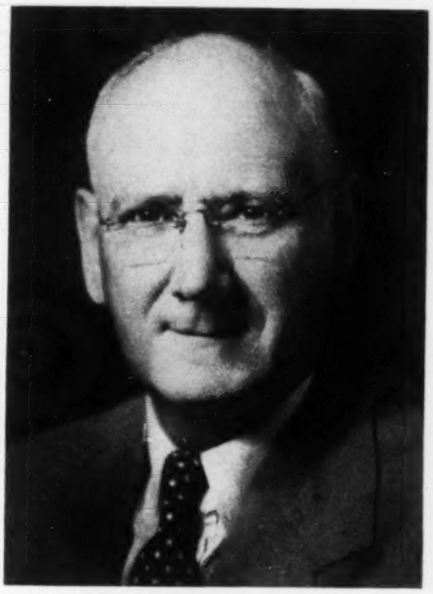
CALIFORNIA VISITORS MEET IN BOSTON (photo left). ASCE Director Julian Hinds, of Los Angeles (left), chats with Trent Dames, Lo Angeles consultant, and Mrs. Dames. Consulting with Franklin P. Thomas, Presidential nominee (center in right photo), are Director C. Glenn Cappel and Past-President W. W. Horner (seated) and (standing) F. de S. Telles, president of Brazil Section, and Charles A. Blessing.

Franklin Thomas Is Nominated for President

FRANKLIN THOMAS, professor of civil engineering and dean of students at California Institute of Technology, Pasadena, was nominated without opposition as the 1949 President of the ASCE by the Board of Direction at its Fall Meeting in Boston. A full member of the Society since 1923, Professor Thomas served as Director from District 11 from 1930 to 1933 and as Vice-President from Zone IV in 1944 and 1945. He was a member of the special Committee on Irrigation Hydraulics from 1922 to 1933, and chairman of the Committee on Accredited Schools in 1937. He has also been active in the Los Angeles Section, which he served as president in 1924.

A graduate of the University of Iowa in 1908 with a B.E. degree, Professor Thomas spent the following year doing graduate work at McGill University. In 1913 the University of Iowa granted him the C.E. degree. Between 1909 and 1913 he was, successively, construction foreman for one year with the Mines Power Co. at Cobalt, Ontario; instructor for two years in the engineering department at the University of Michigan; and designer for a year for the Alabama Power Co.

In 1913 Professor Thomas went to the California Institute of Technology as associate professor to develop the civil engineering department. He became professor of civil engineering in 1915, and during 1917 and in 1920 and 1921 he served as chairman of the administrative committee of the faculty during the absence of the president. In 1919, while on leave of absence from the Institute, he filled a post as assistant engineer for the U. S. Bureau of Reclamation. From 1924 to 1944 he was chairman of the Division of Civil and Mechanical Engineering, Aeronautics and Meteorology at the Institute, and since the latter year he has been dean of students.



FRANKLIN THOMAS
Nominee for President, 1949

Professor Thomas has been a member of the Board of Directors of the Metropolitan Water District of Southern California since its organization in 1928, and served as vice-chairman of the Board from 1929 to 1947. In 1947 Governor Warren appointed him a member of the Colorado River Board of California, and in 1948 he was elected chairman of that Board. Professor Thomas has also served as a consultant on flood control and sanitation projects for the City of Los Angeles and for Los Angeles and Orange counties.

Long interested in civic affairs, Professor Thomas was a member and vice-chairman of the board of directors of the City of Pasadena from 1921 to 1927. He has also been president of the Pasadena Chamber of Commerce, the Pasadena Community Chest, and the Civic Orchestra Association. For "distinguished service to the city" he was awarded the Arthur Noble Medal for 1939.

His affiliations, in addition to ASCE, include membership in Sigma Tau, Tau Beta Pi, Sigma Xi, the American Water Works Association, the California Sewage Works Association, and the American Society for Engineering Education.

Confirmation of Professor Thomas' nomination is scheduled by letter ballot later in the year, and he is expected to take office at the Society's Annual Meeting in New York City next January. A more extensive biography of his career will appear in a later issue.

Board of Direction Elects Five Honorary Members

AT ITS FALL Meeting in Boston the ASCE Board of Direction authorized the award of honorary membership in the Society to five engineers eminent in their respective fields: Charles H. Buford, Lucius D. Clay, Donald Derickson, Gano Dunn, and Andrew Weiss, all members ASCE.

An authority in the field of railroad operation and railroad engineering economics, Mr. Buford is president of the Chicago, Milwaukee, St. Paul & Pacific Railroad, Chicago. He has spent much of his career with the Milwaukee Road, with the exception of a seven-year period (1939 to 1946) as vice-president in charge of operations and maintenance of the Association of American Railroads, with headquarters in Washington, D.C. In the latter capacity Mr. Buford rendered signal wartime service in expediting the movement of troops and supplies, for which he has received five citations.

Gen. Lucius Clay, commander-in-chief of American Forces in Europe and military governor of the U.S. Zone in Germany, has achieved world fame as a military engineer and administrator. As wartime Director of Matériel for the Army, General Clay was in charge of the manufacture and procurement of all Army supplies and equipment. For this service he has been awarded many decorations by the United States and its wartime allies. As an engineer, General Clay has made notable contributions to river and harbor improvement and in the field of flood control. He was largely responsible for the formulation and passage of the first nation-wide federal program for the control of floods, and the technical and administrative procedures required for operation of this tremendous program were established under his immediate direction.

Well known as an engineering educator, Prof. Donald Derickson retired in 1946 as professor of civil engineering and head of the Civil Engineering School at Tulane University, New Orleans, La. Author of widely used college texts on the design of reinforced concrete and joint author of the New Orleans Building Code, Professor Derickson has had papers published in the ASCE TRANSACTIONS and other technical journals. He is interested in the professional problems of the younger engineer and has served on engineering education committees of the Society, the Louisiana Section, and other professional organizations.

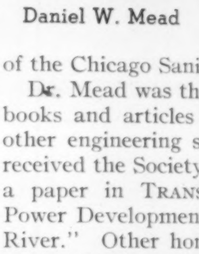
As president of the J. G. White Engineering Corp., New York City, since 1913, and director of various commercial organizations, Gano Dunn is widely known as an engineer and industrialist. He is the author of numerous works on electrical and other engineering subjects, and is the recipient of various honors, including the Edison Medal, the Hoover

Medal, and the Egleston Medal of Columbia University. At present he is a trustee of Cooper Union.

Andrew Weiss, consulting engineer for the National Commission of Irrigation, Mexico D.F., Mexico, has been instrumental in the development of reclamation engineering in Mexico. He is noted also as originator of a method of passing floods over unfinished earth dams during the construction period. Before going to the National Commission of Irrigation in 1932, Mr. Weiss had a long career with the U.S. Bureau of Reclamation and served as resident engineer for the J. G. White Engineering Corp. on construction of two great irrigation projects for the Mexican government.

D. W. Mead, Past-President and Honorary Member, Dies

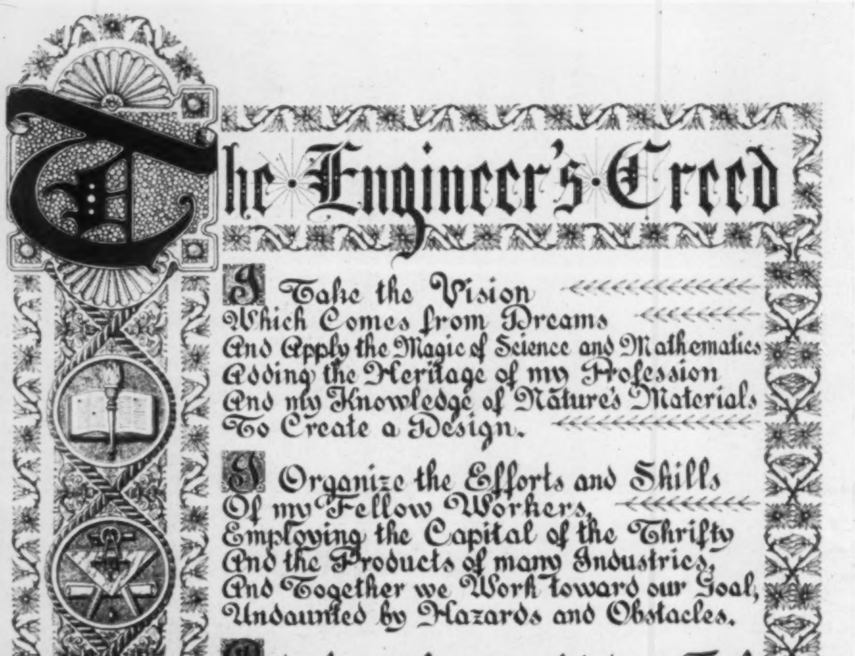
Members of the Society will be grieved to hear of the death of Past-President and Honorary Member Daniel W. Mead, in Madison, Wis., on October 13, after a long illness. Dr. Mead, who was 86, held the chair of professor of hydraulic and sanitary engineering at the University of Wisconsin from 1904 until his retirement from teaching in 1932. From 1896 until recently he also maintained a consulting practice in Madison, with branch offices in New York.


Daniel W. Mead

An authority on hydraulic works and power plants, Dr. Mead built water works for many Middle Western cities. He was a member of the Red Cross Commission to China on flood protection of the Huai River in 1914, and consulting engineer for the Miami Conservancy District from 1913 to 1920. In 1922 President Coolidge appointed him to the Colorado River Board to pass on plans for the Boulder Canyon Project. Later he served as a member of the board representing the federal government in connection with the construction work of the Chicago Sanitary District.

Dr. Mead was the author of numerous books and articles on water power and other engineering subjects. In 1936 he received the Society's Norman Medal for a paper in Transactions on "Water Power Development of the St. Lawrence River." Other honors awarded him included the Chanute Medal of the Western Society of Engineers for the best paper on civil engineering presented before it, and the Washington Award of the same organization and the Founder Societies for "contributions to sound theory, good practice, and high ethical standards."

A full member of ASCE since 1893, Dr. Mead was made Honorary Member in 1931 and served as President in 1936. He had worked on many Society committees, notably those concerned with engineering education and Mississippi River flood control. In 1939 Dr. Mead established and endowed Junior and Student Chapter prizes for papers on ethics.


The·Engineer's·Creed

I Take the Vision
Which Comes from Dreams
And Apply the Magic of Science and Mathematics
Adding the Heritage of my Profession
And my Knowledge of Nature's Materials
To Create a Design.

I Organize the Efforts and Skills
Of my Fellow Workers,
Employing the Capital of the Thrifty
And the Products of many Industries,
And Together we Work toward our Goal,
Undaunted by Hazards and Obstacles.

And when we have completed our Task
All can See
That the Dreams and Plans
Have Materialized
For the Comfort and Welfare of All.

I am an Engineer.
I Serve Mankind
By Making Dreams come True.

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THE ENGINEER IS SEEN AS THE SERVANT OF MANKIND in a creed formulated by Adolph J. Ackerman, M. ASCE, assistant to the president of the Brazilian Traction Light & Power Co., São Paulo, Brazil. Illumination is work of Robert W. Hiller, mechanical engineer and artist of Pittsburgh, Pa.

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ASCE Prizes and Awards Are Announced by Board

ASCE prizes and awards for 1948 were announced by the Board of Direction at the Boston Meeting. Presentation to the following recipients will be made at ceremonies held during the Annual Meeting in New York in January. Further details, together with brief biographies of the recipients, will appear in the January 1949 issue of Civil Engineering.

Norman Medal

Alfred Freudenthal, M. ASCE, for Paper 2296, "The Safety of Structures."

J. James R. Croes Medal

Karl de Vries, M. ASCE, for Paper 2326, "Strength of Beams as Determined by Lateral Buckling."

Thomas Fitch Rowland Prize

M. M. Fitz Hugh, J. S. Miller, and Karl Terzaghi, Hon. M. ASCE, for Paper 2300, "Shipways with Cellular Walls on a Marl Foundation."

James Laurie Prize

Hyde Forbes, M. ASCE, for Paper 2303, "Landslide Investigation and Correction."

Arthur M. Wellington Prize

Joseph Barnett, M. ASCE, for Paper 2309, "Express Highway Planning in Metropolitan Areas."

Collingwood Prize for Juniors

John K. Vennard, Assoc. M. ASCE, for Paper 2295, "Nature of Cavitation."

Rudolph Hering Medal

C. E. Jacob, Assoc. M. ASCE, for Paper 2321, "Drawdown Test to Determine Effective Radius of Artesian Well."

The J. C. Stevens Award

Preston T. Bennett, M. ASCE, for his discussion of Paper 2327, "Relief Wells for Dams and Levees." Second order of merit to Carl E. Kindsvater, Assoc. M. ASCE.

Construction Engineering Prize

C. Glenn Cappel, M. ASCE, for paper in the July 1948 issue of Civil Engineering, "Steel H-Piles and Pipe Bents Support Deep-Water Drilling Platform."

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Society Member Wins 1949 John Fritz Medal

Charles M. Allen

Charles Metcalf Allen, M. ASCE, for many years professor of hydraulic engineering at Worcester Polytechnic Institute and director of the Alden Hydraulic Laboratory there, has been selected to receive the 1949 John Fritz Medal, joint award of the four Founder Societies. A noted engineer, Professor Allen is cited for "exceptional achievement in hydraulic engineering," and as "the founder of a notable hydraulic laboratory; prominent teacher, consultant, inventor, and author."

Professor Allen was given the status of professor emeritus at Worcester Polytechnic Institute in 1945, after a teaching career of 50 years which began upon his graduation there in 1894. Inventor of current meter rating stations, water wheel flow recorders, apparatus for testing for efficiency of gears, and the salt-velocity method of water measurement, Professor Allen has written on these and other hydraulic subjects.

He has been prominent in the American Society of Mechanical Engineers, which elected him to honorary membership in 1944, and is a past-president of the Boston Society of Civil Engineers. Presentation of the John Fritz Medal will be made to Professor Allen at the Annual Meeting of the ASCE, in New York City in January.

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Tellers Canvass Second Ballot for 1949 ASCE Officers

October 15, 1948

To the Secretary
American Society of Civil Engineers:

The tellers appointed to canvass the Second Ballot for Official Nominees report as follows:

For Vice-President, Zone II	
Henry J. Sherman	993
Scattering	80
Void	217
Total	1,290
For Vice-President, Zone III	
Robert B. Brooks	2,125
Void	25
Total	2,150
For Director, District 1	
(Two to be elected)	
Waldo G. Bowman	1,072
Morris Goodkind	1,063
Void	13
Total*	2,148
For Director, District 2	
Harold L. Blakeslee	325
Ernest A. Dockstader	159
Void	3
Total	487
For Director, District 6	
Paul L. Holland	462
Void	1
Total	463
For Director, District 10	
Edmund Friedman	370
Robert M. Angas	240
Void	3
Total	613
For Director, District 13	
Sidney T. Harding	733
Robert J. Newell	169
Void	2
Total	904
Ballots canvassed	6,981
Ballots withheld from canvass:	
Without signatures	44
Total number of ballots received	7,025

Respectfully submitted,

Thomas K. A. Hendrick, *Chairman*
Sherman Glass, *Vice-Chairman*

W. H. Dieck	Frederick W. Ockert
T. R. Kuesel	Richard T. Richards
Harold Garb	Frank W. Hoak
H. F. Hormann	Francis B. Forbes

Edward M. Craig, Jr.

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* Actual number of ballots received 1,074

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New Cumulative Index for "Transactions" Distributed

Publication of a new cumulative index for the ASCE Transactions, now in the mails, will be of interest to those wishing a guide to the Society's technical contributions. The present index, covering the period 1935 to 1947 inclusive, will supplement earlier issues—1921 to 1934 and 1867 to 1920. These three volumes list alphabetically by subject and author all the papers and discussions that have been published in Transactions. Considerably larger than its predecessors, the new 250-page volume has been prepared according to modern ideas of indexing to serve the needs of the expert researcher as well as of the average reader. To this end many new headings have been added, with items frequently listed under several subjects, and numerous cross references included.

Those having standing orders for Transactions will receive the Index in the same binding. For other members and general sales, a stock has been provided at the following prices:

	Members	Libraries	Non-Members
Paper binding	$1	$2	$4
Cloth binding	$2	$3	$5
Leather Binding	$3	$4	$6

NEWS OF LOCAL SECTIONS

Scheduled ASCE Meetings

ANNUAL MEETING

New York, N.Y., January 19–21
(Board of Direction meets
January 17–18)

SPRING MEETING

Oklahoma City, Okla., April 20–23
(Board of Direction meets
April 18–19)

ANNUAL CONVENTION

Mexico City, Mexico, July 12–14
(Board of Direction meets
July 10–11)

Coming Events

Alabama—Joint meeting with the Student Chapters of the Alabama Polytechnic Institute and the University of Alabama, to be held at the Institute, Auburn, November 5.

Central Ohio—Meeting at the Southern Hotel, Columbus, November 12, at 6:30 p.m.

Cleveland—Dinner at the Cleveland Engineering Society, Cleveland, November 19, at 6:30 p.m.; meeting at 8 p.m.

Connecticut—Meeting at the Faculty Club, New Haven, December 1, at 6:30 p.m.

Indiana—Joint meeting with the Student Chapters of the Rose Polytechnic Institute, Purdue University, and the University of Notre Dame in the St. Stephen's Church Parish House, Terre Haute, November 5, at 6:30 p.m.

Louisiana—Meeting in the Jackson Room, St. Charles Hotel, New Orleans, November 29, at 8 p.m.

Maryland—Meeting at the Engineers Club, Baltimore, November 10, at 8 p.m. Preceded by cocktails at 6 p.m. and dinner at 7 p.m.

Metropolitan—Meeting in the Engineering Societies Building, New York City, November 17, at 8 p.m.

Philadelphia—Dinner meeting at the Engineers Club on November 9. Dinner at 6 p.m.; meeting at 7:30 p.m.

Sacramento—Regular meetings every Tuesday at the Elks Temple, Sacramento, at 12:30 p.m.

Tennessee Valley—Annual meeting at the Andrew Johnson Hotel, Knoxville, November 12 and 13. An interesting two-day program of technical sessions and inspection tours is planned.

Recent Activities

ARIZONA

FLOOD HAZARDS PREVAILING along the Salt River between its confluence with the Verde and Gila rivers were described at a recent meeting by W. W. Lane, chairman of a local committee to study flood control problems and determine proper corrective procedures. Mr. Lane pointed out that many sections of the river channel are becoming clogged with growths of salt cedar and tamarisk, which constitute a threat to life and property in the event of a large flow discharging down the channel. Stating that it will be necessary for the state to pass legislation establishing a flood control district, Mr. Lane stressed the importance of informing the public of the situation and obtaining its support if adequate flood-control legislation is to be enacted.

CENTRAL OHIO

SERVICES OFFERED LOCAL technical groups by the Columbus Technical Council were explained by Charles F. Lucks, president of the council, at a recent meeting. The council's present plans include establishment of a speakers' bureau and a long-range program to provide a new technical building for the engineering societies of Columbus. ASCE Mid-West Representative George S. Salter also addressed the group briefly, reporting on the Society's Summer Convention in Seattle, and Prof. G. E. Large commented on the Pittsburgh Meeting, which he attended as Section delegate. During the evening a certificate of life membership was presented to Haig M. Boyajohn, who commented appreciatively on his long connection with the Society.

CONNECTICUT

ENGINEERING RESEARCH IN postwar America was the subject of an address given at the October dinner meeting by Honorary Member Boris Bakhmeteff, professor of hydraulic engineering at Columbia University. The attendance of 68 included 25 senior engineering students from the University of Connecticut, who were guests of the Section.

FLORIDA

IN A TALK on problems of subdivisions, which constituted the technical program at the October dinner mee ing, Joseph W. Davin, vice-president Stockton, Whatley, Davin & Co., re tors and developers, stated that pro lems of water supply and sewage di posal in suburban developments are b coming increasingly acute, and th much of the ocean-front real estate the vicinity of Jacksonville would n warrant the construction of adequa sea walls and bulkheads. An enginee ing degree as a prerequisite to entry in the field of real estate development w advocated by Mr. Davin in conclusio In a general discussion following h talk, David B. Lee, chief engineer of t Florida State Board of Health, stat that an enabling act, which would pe mit the creation of sanitary districts, the best solution to water supply a sewage disposal problems encounter in developing suburban real esta Such a bill was defeated in the la session of the legislature, he pointed o urging the support of realtors in obta ing enactment of a revised bill that w be introduced in the 1949 legislati session.

ILLINOIS

MEMBERS OF THE Illinois Sectio were host at a joint luncheon with t Technical Procedure Committee, whi met in Chicago recently. Introductio were made by George S. Salter, ASC Mid-Western Representative and pre dent of the Illinois Section. There w an attendance of about 40.

INDIANA

CONTINUING ITS CUSTOM begun la fall of having occasional weekend mee ings with neighboring Sections, the I diana Section recently held a two-da joint meeting at Clifty Falls State Par Ind., with the Kentucky and Ci cinnati Sections. Various aspects Society and Section affairs were di cussed at the Saturday night dinn meeting by a panel of ASCE officers Vice-President R. B. Wiley, Direct D. V. Terrell, and Mid-Western Repr sentative George S. Salter. The show ing of a sound motion picture, entitle "Steel for the Ages," concluded th evening program. About 50 enginee and their wives attended the two-da outing and meeting.

NORTHWESTERN

THE OVER-ALL PLAN and develo ment of the Tennessee Valley Authori was explained at the October dinn meeting of the Northwestern Sectio by Albert S. Fry, head engineer of th Hydraulic Data Division of the TVA Mr. Fry supplemented his remarks b showing a colored film of constructio operations on Fontana Dam. Duri the business meeting the Section authorized the award of a $200 scholarship to a senior civil engineering student at the University of Minnesota for the 1948–1949 school year.

PHILADELPHIA

Public works construction in Philadelphia was the subject of discussion at the first dinner meeting of the fall season, which followed an afternoon inspection trip to the Northeast Sewage Treatment Works, the Torresdale Pumping Station, and the Market Street subway extension. The city's ambitious schedule of public works construction, now under way as part of the City Planning Commission's $300,000,000 improvement program, was summarized by Thomas Buckley, director of public works. Other speakers in the symposium were A. J. Maloney, of the Virginia Engineering Co., whose subject was "Prebid Analysis of Job Conditions Affecting Personnel, Plant, and Equipment of the Northeast Treatment Works"; E. J. Taylor, chief of the Philadelphia Bureau of Water, who described the new Belmont ozonation plant; E. H. Thwaits, vice-president of the Preload Corp., New York, who discussed the construction of prestressed concrete tanks; and Howard S. Hipwell, chief engineer of the Philadelphia Department of City Transit, who spoke on the Market Street subway extension.

PITTSBURGH

A talk on underpinning—by Harry Immerman, chief engineer of the New York City consulting firm of Spencer, White & Prentis—comprised the technical program at a recent joint meeting of the Section and the civil section of the Engineers Society of Western Pennsylvania. On another recent occasion members of the Section held a golf party and dinner at the Edgewood Country Club.

ROCHESTER

The Rochester Section sponsored a recent joint meeting with the Buffalo, Ithaca, and Syracuse Sections of the Society and the Peninsula Branch of the Royal Canadian Engineers at Letchworth State Park and Mt. Morris Dam. Talks on the design and construction of the dam, a concrete gravity structure under construction on the Genesee River near Mt. Morris, N.Y., were given by representatives of the Army Engineer district offices at New York City and Buffalo. Present plans call for a concrete dam 1,050 ft long and 240 ft high, with spillway section 550 ft long, making it the highest dam east of the Mississippi. The total estimated cost of the project is $22,000,000.

ST. LOUIS

Resuming its monthly meetings after the summer recess, the St. Louis Section recently sponsored an excursion to Granite City, Ill., for inspection of the Chain of Rocks improvement. At a luncheon meeting preceding the tour of inspection, H. H. Wasung, of New York, resident engineer for the Drilled-in Caisson Corp., described the water intake under construction for the Venice Power Plant. The Chain of Rocks project was then discussed by Col. R. E. Smyser, Jr., of the Corps of Engineers, St. Louis, who stated that contracts for digging a 8.4-mile canal between the Merchants Bridge and a point just south of the confluence of the Missouri and Mississippi rivers will be let next summer. By-passing the hazardous Chain of Rocks reach of the Mississippi River, the canal will remove the last impediment to a dependable 9-ft navigation channel between Minneapolis and New Orleans. Total cost of the canal and locks will be $30,000,000. At the conclusion of Colonel Smyser's talk, the Corps of Engineers conducted a tour of the lock construction area. Of special interest to the group was the concrete manufacturing plant, almost fully automatic, which has been built on the site to provide the required 400,000 cu yd of concrete.

SAN DIEGO

A combined outing and inspection trip to the Palomar Observatory, made jointly by the San Diego and Los Angeles Sections, proved a great success. More than 500 members and their families made the trip to the observatory, where they viewed the recently installed 200-in.-diameter mirror, largest in the world. The mechanism of the powerful telescope was explained by Byron A. Hill, superintendent of construction. The $6,500,000 project was designed and constructed by the California Institute of Technology and financed by the Rockefeller Institute. Test observations for the purpose of adjusting the mirror are being completed at the present time, and actual astronomical observations will be started soon. At the conclusion of the inspection the group adjourned for a picnic lunch and outing.

GEORGIA SECTION

Inspection of Clark Hill Dam near Augusta, and talks by engineers engaged in its design and construction featured a recent meeting of the Georgia Section. Following a tour of the dam, a multiple-purpose Corps of Engineers project under construction on the Savannah River, the group met at an inn near Augusta for a chicken dinner and technical program. The speakers were C. F. Trainor, of the Savannah District of the Corps of Engineers, and C. D. Riddle, project manager for the Allstates Constructors, Inc., who discussed design and construction of the project. Arrangements for the meeting were made by A. C. Marane, J. Crouch, and T. F. Taylor, of Augusta. The attendance of 68 included guests from the South Carolina Section. At the first regular fall meeting, held in Atlanta on October 1, L. L. Adams, assistant chief engineer of the Louisville & Nashville Railroad, gave an illustrated talk on "Hurricane Damage in the 1947 Gulf Coast Storm."

ATTENDING RECENT GEORGIA SECTION INSPECTION TRIP to Clark Hill Dam are, left to right: Mr. Neelands, of Army Corps of Engineers; Ray Pierce, secretary of Georgia Section; C. P. Lindner, chief engineer, South Atlantic Division, Corps of Engineers; Porter Enloe, president of Georgia Section; T. H. Evans, vice-president of Section; and Grady Bain and A. C. Marane, resident engineer and assistant resident engineer on project.

METROPOLITAN SECTION

Careers in railroad engineering were recommended to young engineers by ASCE President R. E. Dougherty, vice-president of the New York Central System, in a talk at the first fall dinner meeting of the Junior Branch. Mr. Dougherty described his engineering experiences with the railroad over a 40-year period, and stated that there will be increasing opportunities in the field in the next few years. Mr. Dougherty also discussed Society affairs, commenting particularly on the recent elections in which the amendments for increasing and equalizing dues were defeated. David K. Serby was named treasurer of the Branch, succeeding William O. Lynch, who is leaving the city to accept a position in Boston.

PRESIDENT R. E. DOUGHERTY CHATS with members of Junior Branch of Metropolitan Section at first dinner meeting of season. With Mr. Dougherty are (left to right) Paul Oberletner, Ralph Angell, Charles Knapp, Ruth Bowen and Brother Joseph Barry, all past or present officers of Junior Branch.

SAN FRANCISCO

An analysis of possible methods of controlling inflation was presented at a recent meeting by Dr. Frank Kidner, director of business and economic research and associate professor of economics at the University of California. Dealing with the causes of inflation as viewed by an economist, Dr. Kidner interpreted them in easily understandable terms. There was an attendance of 120.

SEATTLE

We must continue to give material and educational aid to Europe, according to Judge William J. Wilkins, member of the Allied Court at the Nuremberg Trials, who addressed a recent meeting of the Seattle Section. Speaking on the trials and the present situation in Germany, Judge Wilkins outlined the engineering and other work of restoration that must be done in the near future. In a talk on Society affairs, ASCE Western Representative Walter E. Jessup expressed the opinion that Sections with community interest should have annual or periodic regional conferences, and stated that the Tacoma Section is taking the lead in discussing such a plan.

SOUTHERN IDAHO

The attitude of the Society on numerous matters of professional and technical concern was outlined by Walter E. Jessup, Western Representative, at a recent meeting. Mr. Jessup also described the aims and activities of Engineers Joint Council, and explained how the ASCE and other engineering organizations can participate in government and world affairs through their representation on EJC. J. P. Congdon, Section delegate to the Summer Convention at Seattle, reported on the meeting and the Local Section Conference.

TACOMA

To encourage its younger members to participate in Society and Section activities, the Tacoma Section resumed its custom of presenting a panel of Junior speakers at a recent meeting. The speakers—George Shanafelt, Paul Bent, and Gerald Cavanagh—gave brief talks on technical matters of local interest. In a symposium on "Expansion and Progress of the Tacoma Public School System," Howard R. Goold, superintendent of schools, discussed the general problems confronting the school system and outlined its present construction and development program. Specific problems encountered in the planning, design, and construction of school buildings and stadiums were described by Julian Arntson, chief engineer of the Tacoma schools.

TENNESSEE VALLEY

Public health and safety aspects of the atomic bomb were discussed at a recent smoker and dinner meeting of the Chattanooga Sub-Section by Robert Clark, chief of the Public Health Engineering Division of the TVA. The general physiological hazards of radiation accompanying atomic processes are very great, Mr. Clark told the group. Election of Sub-Section officers for 1949 resulted in the selection of Marion E. Boriss for president, and Ross N. Brudenell, secretary.

The regional development of the Tennessee Valley was outlined at a meeting of the Oak Ridge Sub-Section by Tracy B. Augur, assistant to the director of regional studies of the TVA. Mr. Augur's talk covered the development of the river and valley prior to, as well as since, the inception of the TVA. During the business meeting, W. D. Lavers was elected Sub-Section president for 1949, and George R. Turner, Jr., secretary.

TEXAS

Engineering was cited as an "economy process" in a talk on the "Economics of Engineering," given by C. H. Topping, principal architectural and civil engineer of the E. I. duPont de Nemours Co., at the recent three-day fall meeting of the Texas Section at Tyler. Stating that engineering efficiency is measured by the economy of the structure it produces, Mr. Topping stressed the importance of the practical or economical way of applying solutions to technical problems rather than the actual solutions themselves. Other speakers on the technical program included Oscar H. Koch, Dallas consultant, who spoke on "Master Plan Engineering," and D. C. Greer, state highway engineer, Austin, who discussed the urban development program of the Texas Highway Department. A symposium on the Whitehouse Dam, source of supply for Tyler, was presented by S. J. Buchanan and Ormand A. Stone, with T. C. Forrest, Jr., acting as panel chairman. The efficient functioning of Student Chapters was discussed at a conference of Student Chapter delegates from engineering schools in the Texas Section area. Newly elected officers of the Section are Willard E. Simpson, president, and P. M. Ferguson and H. R. Norman, vice-presidents. I. W. Santry, Jr., continues as secretary-treasurer.

NEWS BRIEFS

Construction Costs Discussed at Public Works Congress

PRICE RESISTANCE WAS seen as a possible threat to continued increases in construction volume by Maj. Gen. Philip B. Fleming, M. ASCE, Federal Works Administrator, in an address at the opening session of the recent Public Works Congress of the American Public Works Association in Boston. Acting as moderator of a panel discussion on construction costs, General Fleming stated that prospects for a continued boom in construction should be good because new construction needs "may be calculated in the tens of billions." However, he warned of increasing reluctance on the part of both private and public agencies to undertake needed construction in the face of present building costs.

"There are reports that it takes a little longer to sell new homes at present prices—that it is a little harder to move older homes at present prices. Prices of construction and wage rates have crept up this year. Interest rates are firming, and the call is for higher down payments and higher monthly payments. Should this trend continue, prices of homes could continue upward. That would result in ever-increasing price resistance, and an increasing withdrawal from the market on the part of potential purchasers." In the field of public construction, General Fleming pointed to the fact that highway construction has not kept pace with current needs because of cost increases.

Every phase of our national life—from building of hospitals and schools to the proposed defense program—will suffer if costs are not lowered, he emphasized. "Somehow," he said, "we must lick the problem of construction costs. Construction is an integral part of the national income. If allowed to drop too low, it could contribute to a recession. Economists tell us that a drop in plant expenditures could well mark a change in the direction of our economy."

In the panel discussion that followed General Fleming's remarks, R. J. Gray, president of the American Federation of Labor, Building and Construction Trades Department, discussed rising construction costs from the viewpoint of labor, and H. E. Foreman, managing director of the Associated General Contractors of America, described the attitude of the contractor on the subject. C. M. Mortenson, executive secretary of the Producers' Council, represented "The Materials Standpoint"; Harrison P. Eddy, Jr., M. ASCE, Boston consultant, gave "A Consulting Engineer's Analysis"; and S. S. Baxter, M. ASCE, assistant chief engineer of the Philadelphia Bureau of Engineering, explained "What the Consumer Thinks."

Other Society members appearing on the four-day program were Mark B. Owen, consulting engineer of Indianapolis, Ind., who discussed old and new methods of refuse incineration before a sanitary engineering session; F. R. Storrer, consulting engineer of Dearborn, Mich., who served as chairman of a round-table discussion on sewerage and sewage disposal; and Sol Ellenson, director of public works for Newport News, Va., who was chairman of a round table on "Organization, Personnel, and Public Relations." J. E. Maring, city engineer of Kansas City, Mo., acted as chairman of a symposium on street maintenance, and E. J. Cleary, executive editor of *Engineering News-Record*, presided at a luncheon meeting that closed the program.

A special feature of the congress was an "Equipment Clinic," which gave users and makers of public works equipment an opportunity to pool their ideas and experience for the benefit of the health and safety of the country. A battalion of Navy Seabees assisted in demonstrating the equipment, which ranged from massive road-building machines to kitchen garbage grinders.

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Continued Increases in Construction Activity Noted Despite Drop in Housing

WITH CONSTRUCTION REACHING the seasonal peak of activity in July and August, the sharp gains of the past spring were replaced by more moderate increases, according to a recent Department of Commerce Industry Report. Interspersed with the gains during these months were declines in one or two of the major phases of the construction situation, notably a sharp August drop in the number of housing units put under construction.

Despite this seasonal decline, however, a new record in terms of dollar value of new construction put in place was established in August for the third consecutive month. Although the August figure, $1,785 million, represented only a moderate 4 percent gain over the revised construction total of $1,719 million for July, it was 31 percent above the August 1947 total for such work.

Privately financed new construction in August of this year, valued at $1,355 million, accounted for more than 75 percent of the total for the month. Privately financed residential construction put in place, with the exception of farmhouses, trailers, and conversions, was valued at $690 million, an increase of 2 percent over July. The value of privately financed nonresidential building was $338 million, representing a similar increase of 2 percent over July. Privately financed utilities spent $245 million, 5 percent more than in July.

Total publicly financed construction for the month was valued at $430 million, an increase of 8 percent over July. Of this total, public residential building amounted to $5 million; nonresidential building, $92 million; military and naval construction, $16 million; highway construction, $190 million; sewer and water facilities, $41 million; and conservation and development, $63 million.

For the first eight months of 1948 all new construction activity amounted to $11,224 million, 35 percent above the figure for the corresponding period of 1947. Private construction, totaling $8,779 million, constituted almost 80 percent of the total and was 36 percent above the dollar volume put in place during the first eight months of 1947. New public construction totaled $2,445 million during the first eight months of 1948, 31 percent above the figure for the corresponding period a year ago.

Construction costs continued their steady upward climb during July, according to the Department of Commerce Composite Index of Construction Costs. With average costs during 1939 equal to 100, the July 1948 Index reached 216.0, an increase of 2 percent over the cost level for June. On the average, the Index indicates, construction costs during July were some 13 percent higher than they were in July 1947.

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Foreign Students Invited Here for Training Course

AS PART OF a program to foster the interchange of technical ideas between the United States and foreign countries, the Worthington Pump and Machinery Corp. has invited 25 foreign students with special qualifications along engineering or mechanical lines for a seven-month training period. Following three months of study at the company's Harrison, N.J., plant, the group will go to its Buffalo works for training on diesel and gas engines, compressors, and power transmission equipment. The last month will be devoted to special training of each student in the field in which he shows special aptitude or in a field of particular importance in his country.

Super-Strength Concrete Runways Described in "Out at Airport" Series

To meet the challenge of increasingly heavy military and civil aircraft, Eugene Freyssinet, a French engineer, has developed prestressed concrete runway pavements which, though relatively thin, are claimed to possess extraordinarily high structural qualities. Reportedly such pavements—described in the current issue of *Out at the Airport*, publication of the Airport Division of the American Road Builders Association—can carry loads 15 times greater than concrete of the same thickness but ordinary design.

The publication states that, "The developer of this type of high-strength concrete pavement claims that its slightly less than $6^{1}/_{2}$-in. thickness has the equivalent strength of ordinary concrete 24 in. thick. Temperature stresses in such slabs would be reduced substantially due to its thinner section, and the resultant lowering of temperature differentials in the under and upper portions of the slabs.

"Creators of prestressed concrete pavements claim these extraordinary strength characteristics are accomplished in part by incorporating in the pavement structure a system of stressed high-strength cables. Some of the cables are anchored to a series of deeply embedded concrete abutments placed 26 ft below the ends of paved areas. A portion of such pavements is reinforced longitudinally and transversely, using the same type of cables employed transversely in the pavement proper. Through the use of the cables and the resistance due to the confining effect of the end-abutments, prestressing of the concrete takes place."

The runway under study was installed over a thoroughly consolidated foundation 14 in. thick, plus a 2-in. sand cushion. The publication states that, "In addition, concrete beams underlie the joints. Such beams are presumably installed longitudinally as well as at transverse joints. The experimental pavement, which was installed at a major airfield near Paris, was precast in 1.20-sq yd blocks. Prestressed cables, installed transversely within the pavement area, are placed between the joints of the blocks."

According to the publication, it seems probable that significant economies can be effected in the quantity of materials required in concrete pavement slabs themselves by installing prestressed steel cables in the manner prescribed by Freyssinet. However, it makes clear the fact that actual cost data on the development are not yet available, and states that proponents of conventional concrete pavements claim that the relatively heavy foundation requirements, plus the intricate system of cable requirements, the underlying concrete beams, and the deep and heavy abutments required, will offset to a substantial degree the savings that might result from drastic reduction in slab-thickness requirements.

The publication states in conclusion that, "Some American airport pavement installations call for concrete 21 in. thick to support extremely heavy plane loads. Therefore, it is obvious that the development of prestressed concrete runways will be watched with more than usual interest in the hope that savings can be effected in the cost of pavements on airfields, and that materials required in such pavements can be conserved. If tests show that these advantages could be added to those which are already common to conventional forms of concrete pavements, the benefits to airport development would be significant, indeed."

World's Brightest Lights Installed at International Airport

FIRST FULL COMMERCIAL INSTALLATION OF NEW ALL-WEATHER LIGHTS, developed by Westinghouse Corp., lines 3,000-ft approach pier at New York International Airport, Idlewild, Queens. At extreme left is first krypton light, capable of flashing 40 times per minute at 3,300,000,000 peak candlepower to penetrate 1,000 ft of "zero zero" fog. Intensity can be varied in accordance with weather conditions. Krypton units alternate every other light with neon lights of lesser brightness—35 krypton and 34 neon.

Members Address Conference on Industrial Hydraulics

Fundamental and applied aspects of hydraulics were discussed at the recent fourth annual National Conference on Industrial Hydraulics, held in Chicago under the auspices of the Illinois Institute of Technology's Graduate School and its Armour Research Foundation. Other sponsoring organizations were the Illinois Section of the ASCE, the Western Society of Engineers, and local groups of the ASME and the Society of Automotive Engineers.

The background and aims of the conference were outlined at a luncheon meeting initiating the two-day session by W. A. Lewis, dean of the Graduate School at the Institute. The relationship of each of the participating groups to the conference was then explained by a panel of engineers, with ASCE Mid-West Representative George S. Salter speaking on behalf of the Society, and V. O. McClurg, M. ASCE, representing the Western Society of Engineers.

Other Society members on the program included J. F. Roberts, of Milwaukee, Wis., and S. Logan Kerr, Philadelphia consultant, who presented papers in a technical session on "Pumps and Turbines," under the chairmanship of T. M. Niles, of the Chicago firm of Greeley & Hansen. Victor L. Streeter, M. ASCE, director of fluid mechanics for the Armour Research Foundation, was director of the conference.

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New Engineer District Is Established by Army

Formation of a new engineer district in the North Pacific Division of the Corps of Engineers, with headquarters at Walla Walla, Wash., has been announced by Col. Theron D. Weaver, North Pacific Divison Engineer. The new district office will direct civil works functions of the Army in the Snake River basin and in the Columbia Basin from Irrigon, Ore. (seven miles downstream from Umatilla), to the mouth of the Yakima River.

Construction of McNary Dam constitutes the current major project of the new Walla Walla District. In addition, construction operations on Mill Creek at Walla Walla, on the Heise-Roberts Project on the Snake River in eastern Idaho, and emergency flood control and navigation work elsewhere in the area are under way. Scheduled projects include the planning of four dams on the Snake River between its mouth and Lewiston, Idaho, and of the recently authorized Lucky Peak Dam on the Boise River, and construction of these projects as funds become available.

Col. William Whipple, Assoc. M. ASCE, since May 1947 executive officer of the North Pacific Division, with headquarters in Portland, will be district engineer at Walla Walla. A graduate of the U.S. Military Academy at West Point, Colonel Whipple was on river and harbor duty in the Missouri Basin from 1937 to 1940, and during the war served as chief of the Logistical Plans Branch, in the European campaign.

Decrease in Industrial Accidents Is Reported

GRATIFYING DECREASES IN construction and industrial accidents were reported by Carl B. Jansen, M. ASCE, president of the Dravo Corp., Pittsburgh, in an address on "Management's Approach to the Safety Problem," given before the recent President's Conference on Industrial Safety. "Many years ago," he pointed out, "certain rule-of-thumb statistics were the basis of approach to the accident problem on building and construction work—for instance, the premise that it was not unreasonable to expect one fatality for every floor of a building under construction, or that two men might well lose their lives per mile of tunnel driven. Fortunately for all of us, this approach has long since been discarded."

Industrial hazards have been reduced by present-day practices of designing for safety, according to Mr. Jansen. "This is especially important on new plant construction," he stated, "where it is possible to lay out permanent work areas with a view to providing the minimum of interference and of hazards. Where ladders were once common practice, stairways equipped with adequate handrails now take their place—and incidentally provide more economical and rapid movement by employees. Modern heating and ventilation provide more healthful work space. Decided improvement has also taken place in the tools provided by management for use of employees. This applies to hand tools and to mechanical equipment operated manually."

In addition to good engineering design and control, Mr. Jansen stressed the necessity of training employees in safety measures and cited the role of the safety engineer in modern industrial functioning. In conclusion, he urged cooperation between management and labor as essential to the working out of any effective safety program.

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AISC Presents Awards for Most Esthetic Steel Bridges

IN MAKING ITS first awards for beautiful bridges since the outbreak of the war, the American Institute of Steel Construction declared that the American landscape has been greatly enhanced by the artistic design of new steel bridges opened to traffic in the years from 1942 to 1947. The four classifications in the competition are as follows: Class I, fixed bridges with spans of 400 ft or more; Class II, fixed bridges with spans under 400 ft, costing over $500,000; Class III, fixed bridges with spans under 400 ft, costing less than $500,000; Class IV, movable bridges. The awards for structures built during this seven-year period were announced recently by the American Institute of Steel Construction.

Members of ASCE head many of the engineering firms honored for their prize-winning designs. These include an award, in Class I, to Howard, Needles, Tammen & Bergendoff, New York and Kansas City, for design of the Julien Dubuque Bridge across the Mississippi River, which was opened to traffic in 1943.

Class II awards went to the New York consulting firm of D. B. Steinman for design of the Charter Oak Bridge across the Connecticut River at Hartford, Conn. (1942); Modjeski & Masters, Harrisburg, Pa., for the Pecos River Bridge on the Southern Pacific Railway across the Pecos River between Del Rio and Langtry, Tex. (1944); and to Howard, Needles, Tammen & Bergendoff for the Saco River Bridge on the Maine Turnpike near Saco, Me. (1947).

In Class III, an award was made to Howard, Needles, Tammen & Bergendoff, designing engineers for the Old Alfred Road Underpass on the Maine Turnpike (1947). The same firm received the 1945 award in Class IV for the President Harry S. Truman Bridge across the Missouri River at Kansas City. Another award in Class IV was made to the Absecon Boulevard Bridge over Beach Thoroughfare at Atlantic City, N.J. (1946), designed by the Division of Bridges, New Jersey State Highway Department, with Morris Goodkind as bridge engineer, and Howard, Needles, Tammen & Bergendoff as consultants for the superstructure of bascule and flanking spans.

Honorable mention, in Class IV, went to the Cheesequake Creek Bridge at Sayerville, N.J. (1943), which was designed by the New Jersey State Highway Department, with Morris Goodkind as bridge engineer and Howard, Needles, Tammen & Bergendoff as consultants for superstructure of bascule and flanking spans. In Class III, for 1947, honorable mention was given to the Klingle Road Bridge at Rock Creek in the District of Columbia, designed by Gilmore D. Clarke, Michael Rapuano, and Leslie G. Holleran, consulting engineers and landscape architects of New York City.

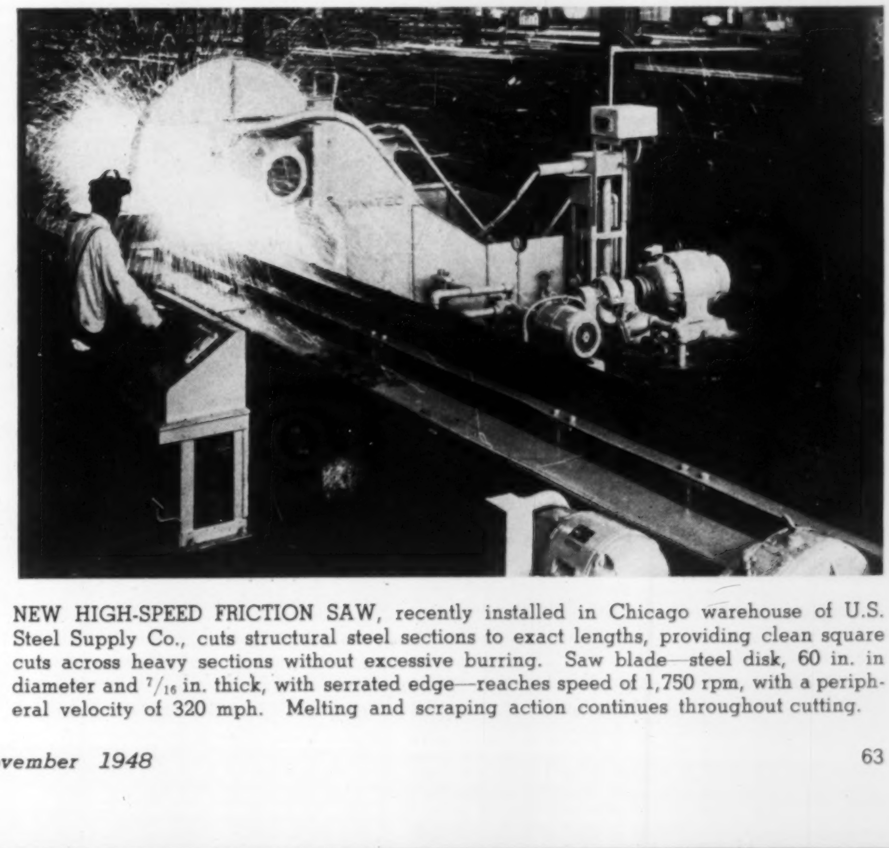
Wider Use of Timber for Structural Building Seen

INCREASED USE OF timber for structural purposes was forecast at the recent Wood Industries Conference of the American Society of Mechanical Engineers at High Point, N.C. Speaking at one of the sessions of the two-day technical program, F. Powell Forbes, manager of the engineering and fabrication division of the Weyerhaeuser Timber Co., stated that through lack of adequate design information, lumber for heavy structures was "pushed into the background with the coming of steel and concrete. Its use also waned because of the weakness of the joints, particularly in tension."

Calling the introduction of timber connectors into this country "the greatest contribution to timber in 300 years," Mr. Forbes said, "Engineers immediately found a new system of timber construction available which increased the strength of bolted joints from two to six times, made wood tension members practical, and made structural members smaller because the joints could develop the full strength of the member."

Among other factors pointing toward an increase in the use of timber for structural purposes, the speaker listed the development of new design data, formation of the timber-fabrication industry, and the growth of a new attitude toward timber as a structural material as a result of its record in World War II. "As improvements are made in production techniques by the fabricators, there will be a corresponding advance in the art of timber design," he predicted.

High-Speed Friction Saw Saves Time and Labor



NEW HIGH-SPEED FRICTION SAW, recently installed in Chicago warehouse of U.S. Steel Supply Co., cuts structural steel sections to exact lengths, providing clean square cuts across heavy sections without excessive burring. Saw blade—steel disk, 60 in. in diameter and $^7/_{16}$ in. thick, with serrated edge—reaches speed of 1,750 rpm, with a peripheral velocity of 320 mph. Melting and scraping action continues throughout cutting.

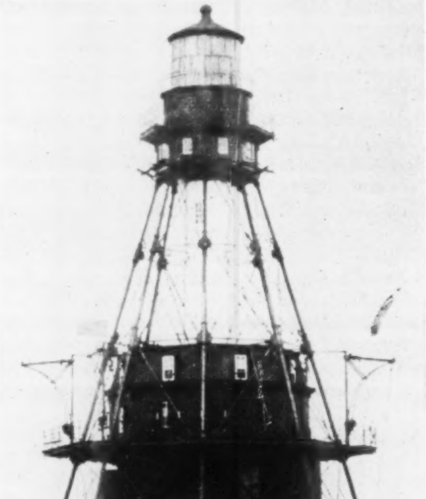
Century-Old Wrought-Iron Structures Are Still in Good Condition

Six tall, pyramidal lighthouses—in service for almost a hundred years on the Florida reefs between Miami and Key West—are monuments to the ability of the engineer of a century ago and to the durability of early structural materials. Recent inspection of these open framework wrought-iron towers by the Civil Engineering Section of the Miami District Coast Guard showed them to be in an excellent state of preservation, despite frequent tropical hurricanes and battering waves, the corrosive effects of salt water and sea air, and the abrasive action of shifting sand. Minor repairs needed were confined mainly to the replacement of turnbuckles and tie rods.

In 1837, following many disastrous shipwrecks on the reefs, Congress appropriated funds for the construction of the first light at Carysfort Reef. Actual construction started in 1848, and the series was completed in 1880. The structures—located along a 145-mile stretch of coastline at Carysfort Reef, Sand Key, Sombrero Key, Alligator Reef, Fowey Rocks, and American Shoals—range in height from 117 to 160 ft. With the exception of the Sand Key Lighthouse, all stand in from 1 to 4 ft of water on foundations varying from coral crust over soft sand to hard coral rock. Although the Sand Key Lighthouse (completed in 1853) does not stand in water, it has been exposed to severe storms that have carried away or inundated everything else on the island.

Support for the structures ranges from nine 8-in.-dia solid wrought-iron piles forming an octagon with one central pile for the light at Carysfort Reef to 2-ft screw piles, without foot plates, for the Sand Key light. The other four structures are supported on 12-in.-dia piles, driven into coral rock to maximum depths of 19 ft.

All pile heads are fitted with cast-iron sockets that receive wrought-iron radial and peripheral ties. Diagonal bracing, by means of tension rods attached to lugs on the sockets and foundations, makes the framework rigid. Quarters for personnel manning the stations are built of boiler iron. These are one or two stories in height, and are connected to the watchtowers by a cylinder containing a spiral stairway.



AMERICAN SHOAL LIGHTHOUSE off Florida Keys, last of six constructed by Coast Guard on Florida reefs, was completed in 1880. To strengthen structure against hurricanes, new wrought-iron tie rods and turnbuckles are being installed. Work is under direction of U.S. Coast Guard. Photo furnished by A. M. Byers Co.

◆

Bid Calls on Western Projects Announced by Bureau of Reclamation

Several Western construction projects, on which work is about to begin, are announced by the Bureau of Reclamation in its *Advance Construction Bulletin* for October 1, under the head of "Bid Calls Expected This Month." The release includes revised information for the Cedar Bluff Dam of the Missouri Basin Project, originally listed in the Bureau's September Bulletin and noted in the September issue of Civil Engineering.

EARTHFILL DAM
Missouri Basin Project, Kansas

Location: On the Smoky Hill River about 14 miles south of Ogallah, Kans.

Work: Construction of Cedar Bluff Dam, an earthfill structure approximately 134 ft high and 12,500 ft long.

Excavation (common) for foundation of dam	1,125,000 cu yd
Excavation (all classes) for outlet works and spillway	1,300,000 cu yd
Excavation (common) and transportation to dam	9,700,000 cu yd
Earthfill in embankment	8,100,000 cu yd
Quarrying, transporting and placing riprap	211,000 cu yd
Furnishing and placing gravel blanket	106,000 cu yd
Concrete in spillway and outlet works	46,000 cu yd
Furnishing and handling cement	69,000 bbl
Furnishing and placing reinforcing steel	5,000,000 lb
Erecting structural steel for bridge	210,000 lb
Installing high pressure gates, valves, and controls	106,000 lb
Installing outlet pipe	167,000 lb
Installing all other metal work	31,000 lb
Time Allowed for Completion:	1,300 days

CANAL
Central Valley Project, California

Location: Near Patterson, Calif.

Work: Construction of earthwork, concrete lining, and structures for about 15 miles of the Delta-Mendota Canal.

Excavation	5,000,000 cu yd
Concrete in lining	117,000 cu yd
Furnishing and placing reinforcing steel	1,950,000 lb
Time Allowed for Completion:	750 days

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Army Engineers Open Bids on Large Veterans' Hospital

Bids for construction of a 500-bed veterans' hospital, to be built in the suburbs of Detroit, Mich., have been opened according to a recent announcement from the Detroit District office of the Corps of Engineers. Designed as an up-to-date hospital for the care of tuberculous patients, the project will consist of a ten-story main building of reinforced concrete, with an exterior of limestone. Separate personnel quarters, and a service building housing a boiler house, laundry, shops and garages will be provided. Estimated to cost approximately $10,000,000, the hospital will be located on a 40-acre landscaped site.

Harley, Ellington & Day, of Detroit, were architect-engineers in the preparation of the design and specifications for the Detroit Engineer Office.

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Illinois U. Research Cuts House Construction Costs

Improved construction methods, under study by the Small Homes Council at the University of Illinois during the past year, make possible a 10 percent reduction in the cost of building houses designed with non-load-bearing partitions, the Council reports. Saving in both labor and materials, according to the Council, will result from building a house as one room and then installing interior partitions that do not carry any of the load of the structure.

These partitions are erected only after the floors are laid, ceilings and walls finished, and plumbing installed. Rafters and ceiling joists are put together on the ground in the form of triangular frames, which are lifted into place as units. Interior and exterior walls are also put together as complete units while flat on the floor and then raised into position.

Details of the study, a cooperative research project of the University of Illinois and the U.S. Department of Commerce Office of Technical Services, are presented in a twelve-page circular that may be obtained without cost from the Small Homes Council, University of Illinois, Urbana, Ill.

Construction Roundup

From the Construction Industry Information Committee—Washington, D.C.

RESEARCH ON METALS used in building has brought about new uses for old materials, the development of new materials, more efficient structural designs, and savings in both labor and materials. Great emphasis has been placed recently on the development of light materials for light loads, bringing economy both in the use of material and in handling by labor, and in many cases greater convenience to owners of buildings.

As a result, we now have light steel framing for house construction, which may be used with any type of covering and is applicable to any style of house. Light-gage steel also provides a new structural floor system which enables the electric wiring system in commercial buildings to be revised according to changing needs with negligible cutting or patching of floors, walls, and ceilings.

Development of aluminum alloys has given us many widely used light-weight products: vertically swinging garage doors, double-hung and casement window sash, revolving and swinging doors, frames, roofing, siding, flashings, eaves troughs and downspouts, and all kinds of ornamental work. Since aluminum keeps weight down, it has made power tools feasible for use by building workers. Structural use of aluminum has also expanded greatly. Magnesium, weighing a third less than aluminum and now available in quantity at prices allowing a considerable range of uses, has also worked its way into builders' equipment.

Meanwhile, the long-established construction metals undergo constant research and improvements. Copper has been used for centuries for better-grade sheet metal work and brass for better grade hardware. But experiment and development of new alloys and of new manufacturing equipment has multiplied the uses of copper in construction, especially in plumbing and heating systems. Copper flashings to protect masonry walls have benefited from modern design and technique so that tailor-made results may be had from stock sizes.

The iron and steel industry's numerous research projects include studies of the most economical and efficient use of steel in reinforcing concrete. Considerable progress also has been made in preventing corrosion in steel pipe and pipe linings.

◆

Members Honored by Union of Geodesy and Geophysics

SEVERAL MEMBERS OF the ASCE—Merrill Bernard, Henry W. Hemple, Floyd W. Hough, and Waldo E. Smith—were among the 67 delegates and guests from the United States to the Eighth General Assembly of the International Union of Geodesy and Geophysics, held recently in Oslo, Norway. Mr. Bernard, who represented the ASCE, was elected president of the International Association of Hydrology, and Mr. Hemple was designated representative of the International Union of Geodesy and Geophysics on the committee of experts considering cartographic matters for the United Nations. F. A. Vening Meinesz, geodesist and geophysicist of the Netherlands, was elected president of the International Union.

The Ninth General Assembly will be held in Brussels, Belgium, in 1951.

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Essay Contest on Highway Subjects Is Announced

TO PROMOTE INTEREST in highway engineering as a career, the American Association of State Highway Officials is conducting a nationwide contest for civil engineering students and faculty members. The topic for student contestants is, "What I Think of Highway Engineering as a Career." Papers submitted by faculty members are to be on the subject, "What I Advise My Students with Regard to Selecting Highway Engineering as a Career." Winners will be guests of the AASHO at its 1949 annual convention in San Antonio, Tex., where they will present their papers.

Details of the contest may be obtained from the AASHO, 1220 National Press Building, Washington 4, D.C.

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Steel Production Reaches Record Peacetime High

STEEL PRODUCTION IN the first nine months of 1948 reached a record peacetime high, with a total only 2 percent less than for the entire year of 1946, according to a recent announcement of the American Iron and Steel Institute. The output of ingots and steel for castings in this period totaled 64,987,478 tons, an increase of 3.6 percent over the 62,705,851 tons produced in the corresponding period of 1947.

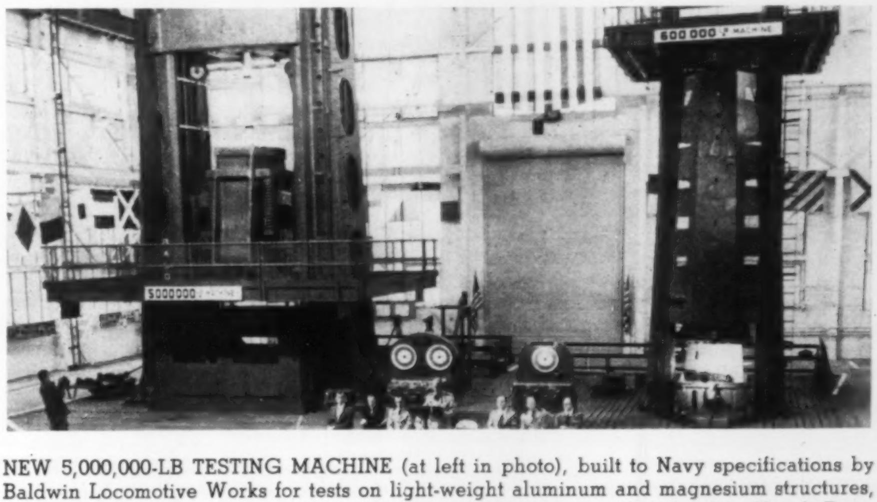
Production for the third quarter, 21,920,000, exceeded the output of 21,046,163 tons in the second quarter and of 20,367,294 tons in the third quarter of 1947. Production during September, 7,413,934 tons, was slightly under the August output of 7,437,608 tons, and considerably above the September 1947 total of 6,797,457 tons.

Positions Announced

Alaska Road Commission. Opportunities for engineers and draftsmen in Alaska are announced by the Alaska Road Commission, which is commencing a three- to five-year program of surfacing the main highways of the territory. Vacancies exist in the grades of assistant superintendent, road, structural, safety, cost, and other engineering positions as well as for draftsmen and engineering aids. Salaries are at normal Civil Service rates, plus 25 percent. Applications should be on Standard Form 57, addressed to the Alaska Road Commission at Juneau, Alaska.

U.S. Civil Service Commission. Engineers interested in filling positions in the P-1 grade ($2,974 a year) in Washington, D.C., and vicinity, should file applications with the U.S. Civil Service Commission, Washington 25, D.C. To qualify, candidates must have completed four years of college study in professional engineering leading to a bachelor's degree, or have had four years of progressive technical experience or a time-equivalent combination of the two. No written test is required.

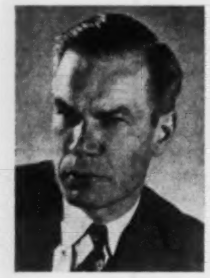
Navy Demonstrates Huge Testing Machine



NEW 5,000,000-LB TESTING MACHINE (at left in photo), built to Navy specifications by Baldwin Locomotive Works for tests on light-weight aluminum and magnesium structures, is demonstrated in Aeronautical Structures Laboratory at Philadelphia Naval Base. World's largest testing device, machine can accommodate specimens up to 30 ft high, 10 ft wide between columns, and 50 ft long for tension, compression, or flexure testing.

Institute of Transportation and Traffic Organized at University of California

CALIFORNIA IS TAKING the lead in developing university and college programs in the important field of transportation and traffic engineering, with organization of an Institute of Transportation and Traffic Engineering at the University of California. Established by act of the 1947 legislature with an appropriation of $355,000, the Institute will aid in the development of the state highway program. Although the development and improvement of highways is the immediate objective of the Institute, the bill provides for ultimate attention to other modes of transportation.


Harmer E. Davis

Donald Berry

Ralph Moyer

As an agency of the university, the Institute will have an educational program covering three general types of training: (1) Graduate and undergraduate courses training engineers to man the proposed construction program; (2) various phases of in-service training, consisting of short courses for the training of state, county, and city engineering personnel; and (3) dissemination of factual information to public agencies and groups of a non-engineering nature.

The graduate and undergraduate courses leading to degrees in Transportation Engineering will be offered on the Berkeley campus, where facilities for physical research and research on vehicle equipment are also available. On the Los Angeles campus problems of driver characteristics and safety will be emphasized, and a research program is already under way there to determine the relation of the vehicle driver to road operation.

At present the Institute staff consists of five engineers, headed by Harmer E. Davis, Assoc. M. ASCE, as acting director. Professor Davis received his assignment in May, and since then has been active on the organizational work of the Institute. A member of the University of California teaching and research staff since 1930, Professor Davis is widely experienced in the field of highway materials and research. Donald S. Berry, Assoc. M. ASCE, for the past twelve years traffic engineer for the National Safety Council, is newly appointed assistant director of the Institute and professor of transportation engineering. Dr. Berry has published extensively on traffic engineering subjects and has served on numerous national committees for traffic training, control and education.

Ralph A. Moyer, Assoc. M. ASCE, also a recent appointee, is research engineer of the Institute and professor of civil engineering in the Civil Engineering Division of the University on the Berkeley campus where he is in charge of the undergraduate and graduate courses in highway engineering. Professor Moyer comes to the staff from Iowa State College where he was research professor of civil engineering. An authority on highway economics and highway safety, he was on the Iowa State staff for the past 27 years. He is widely known for his research and publications in highway engineering and for his work with the Highway Research Board, which he is now serving as vice-chairman.

Other staff members are Cecil J. Van Til, who will serve as lecturer in transportation and teach airphoto interpretation, and Fred N. Finn, Jun. ASCE, lecturer and administrative assistant for the Institute.

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Army Establishes Organized Reserve Research and Development Groups

MUCH OF THE failure of the armed forces to utilize scientifically trained manpower to the maximum during World War II is due to the failure of peacetime Reserve training to keep pace with the professional interests of engineers and scientists in civilian life, according to a recent survey cited by the Department of the Army. To establish a Reserve officers' training program that will pose an intellectual challenge to men of scientific training, the Army is forming Organized Reserve Research and Development Groups.

An announcement from the Army states that the objectives of the program, which will be of special interest to engineers and scientists, are to: (1) Maintain the useful affiliation of civil engineers and other scientists with the Organized Reserve Corps; (2) provide peacetime Reserve assignments for these officers, enabling optimum utilization of their education, experience, and skills; and (3) to furnish mobilization assignments, which will fully realize the talents of these officers and adequately prepare them for mobilization.

The Technical Services of the Department of the Army submit to these Research and Development Reserve Groups research problems and projects that will challenge the interest of the members, thus providing them with a type of training in keeping with their scientific and technical interests and abilities. Provision is being made to submit research projects of interest to all categories of scientists—chemists, physicists, engineers, geologists, geographers, psychologists, mathematicians, and all the biological scientists.

The program is being implemented only in areas where there is definite local interest, with 18 of the Research and Development Reserve groups already organized and 12 additional groups in process of formation. Several of these groups have been organized in communities, where there are large universities, industrial research laboratories, or private research foundations.

Reserve officers who are currently engaged in civilian research, college or university teaching, or industrial research or development, or who in the past have had specific research experience are eligible to apply for assignment to an Organized Reserve Research and Development Group. A group may be organized in any locality where there are 20 or more qualified officer scientists who desire to participate in the program. A subgroup may be organized with ten qualified members.

The program, under the general direction of the Research and Development Group, Logistics Division, General Staff, United States Army, is outlined in Department of Army Circular Number 127, dated May 5, 1948. Inquiry about organization of an Organized Reserve Research and Development Group or about assignment to a group already organized should be made of the Unit Instructor, ORC, or of the Senior Army Instructor, ORC, in the locality in which the officer resides.

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Dates of New York State Examinations to Be Changed

DATES FOR THE New York State semi-annual examinations for professional engineers, engineers-in-training, and land surveyors have been shifted from February and June to May and November, with the next examinations scheduled for May 17 and 18, 1949. New deadlines for filing applications are February 1 and August 1 for candidates for the professional engineer and land surveyor examinations, and September 1 for the engineer-in-training candidates.

◆

Salary Survey of Recent Alumni Ranks Civils Second

AVERAGE STARTING SALARIES for June 1948 graduates in engineering and science at Illinois Institute of Technology are $264.72 per month for a 40-hour week, or 53 cents less than the beginning salary of the February 1948 class, according to the institute's placement service. Civil engineers retain second place, although their starting salary has fallen from $289.75 in February to $280.73. The ASCE minimum starting salary, established in October 1946, is $225

N. G. NEARE'S Column

R. Robinson Rowe, M. ASCE

SOME OF THE boys hadn't done their homework. During dinner at the Engineers Club they were still working feverishly on the problem of three men rolling five dice to see who rolled the fifth ace. They weren't working with slide-rules. With a more realistic synthesis, they were organized in three-man parties fully equipped with field book, five honest bones, and a shaker.

The Professor hated to break it up. "Let's consolidate all the field data," he said, and found the score for 30 trials in tabular form. Twice the third man had been stuck in the first round, half of the payoffs were in the second round and some trials required four rounds. "What's your conclusion, Joe?"

A	B	C
0	0	2
4	6	5
4	3	2
2	1	1

"They are all even on the face of it, Professor, but there's one obvious discrepancy. Five rolls will show 25 dice, of which 24 should be, on the average, 4 of each face. There is one chance in 6 that the 25th is the 5th ace. But 6 rolls will show 30 dice and a fair certainty of 5 aces. So in the second round the third man will pay much more often than the second man. With this deduction, Tom and Harry should make Dick start in third place."

"But the average rarely happens," objected Cal Klater. "Actually Dick's scheme is so fair that we have to analyze a bigger sample than 30, so big that it will be quicker to expand the binomial $[(5/6)+(1/6)]^{5n}$ by the binomial theorem. The complete expansion will have $5n + 1$ terms adding up to unity and giving in order the probabilities that 0, 1, 2, . . $5n$ aces are cast in n throws of 5 dice. To get the chance that less than 5 aces are cast, we can add the first five terms:

$$\begin{aligned} q_n = {} & (5/6)^{5n} + 5n(5/6)^{5n-1}(1/6) + \\ & 1/2\, 5n(5n-1)(5/6)^{5n-2}(1/6)^2 + \\ & 1/6\, 5n(5n-1)(5n-2)(5/6)^{5n-3}(1/6)^3 \\ & + 1/24\, 5n(5n-1)(5n-2)(5n-3) \\ & (5/6)^{5n-4}(1/6)^4 = (5/6)^{5n} \end{aligned}$$

$$\left(1 + \frac{1{,}367}{1{,}500}\, n + \frac{251}{600}\, n^2 + \frac{7}{60}\, n^3 + \frac{1}{24}\, n^4\right)$$

This formula gives us quickly for consecutive throws:

n	q_n	$p_n = \Delta q_n$
0	1.000000	0.000000
1	0.999871	0.000129
2	0.984538	0.015333
3	0.910234	0.074304
4	0.768749	0.141485

and the differences, pn, are the probabilities for the 5th ace appearing on a particular throw. For the first man, $n = 1, 4, 7$ . . for which the total probability is P_1 0.33808. Similarly, $P_2 = 0.32785$ and $P_3 = 0.33407$, so that Tom and Harry should make Dick start first."

"A nice demonstration, Cal, but we'll have to warn the boys not to generalize. In a group of 4 or 5 topers, Dick should be made to start last, and always fifth in larger groups.

"The theme for our new problem could be the wrestling of box springs up an attic stairway, but I'll make it easier by staging it on the level, at the ell formed by a 13-ft corridor joining at right angles a hallway only 5 ft 5 in. wide. What is the largest rectangular desk which can get around the ell without tipping? And don't just tell me it's the boss's desk, because his went in sideways."

[*Cal Klaters were the regular Richard Jenney, John L. (Stoop) Nagle, and Ed C. Holt, Jr. Another solution of the Gooey Gulch Bridge problem came from bridger Raymond A. Warner. He and several others are still working variations of the July tunnel teaser.*]

NEW IN Education

WITH A GRANT of $2,000 from the Research Corp., of New York City, the Virginia Polytechnic Institute Wood Research Laboratory is conducting studies to determine formulas for the design of wood box columns. More than 100 tests on full-sized columns of different cross sections and varying plank thicknesses and arrangements, with the planks nailed or nailed and glued, are planned. With the availability of these test data, it will be possible to make more satisfactory use of wood box columns, especially in designing with wood. The investigation is being performed, under the supervision of E. George Stern, Assoc. M. ASCE, director of the laboratory, by Prof. B. Y. Kinzey, of the V.P.I. department of architectural engineering, assisted by O. J. Blake, fellowship graduate student.

MODEL INVESTIGATIONS OF the effects of the raising and lowering of reservoir levels behind earth dams are under way in the soil mechanics laboratory at Northwestern University, under the direction of Prof. Philip C. Rutledge, Assoc. M. ASCE, and Asst. Prof. Howard P. Hall, Jun. ASCE. Covering investigation of the rate of development of seepage through earth dams and the rate of lowering of ground water around wells, the investigation is expected to increase present knowledge of transient flow of ground water and, ultimately, to permit more economical design of dams and more reliable analysis of water supply and drainage problems. The present model investigations use closely spaced glass plates and viscous fluid, instead of water, which slows down tests so that photographic records and measurements may be made.

THE CURRENT YEAR marks the 75th anniversary of the teaching of civil engineering at the University of Notre Dame. Under the head of "Specialities," the university catalogue for 1872–1873 carried the following announcement: "Civil Engineering—this important branch study will be commenced next session and will afford our advance students the opportunity long desired of fitting themselves for important professions in life." The first degree of Civil Engineer was conferred in June 1875, and from then until 1886 only two more degrees were granted in this "specialty." Growth of the department was more rapid from then on, and by 1897 two more engineering departments had been started and the college of Engineering was organized.

BENEFITS OF THE four-wheel-drive principle to automotive transportation are being studied and evaluated at the University of Wisconsin College of Engineering in a research project sponsored by the Four Wheel Drive Auto Co. The original grant to this project was $50,000, and an additional $15,000 is being given to continue the studies another year. Suggestions resulting from the study will be incorporated in the company's continuous design-improvement program.

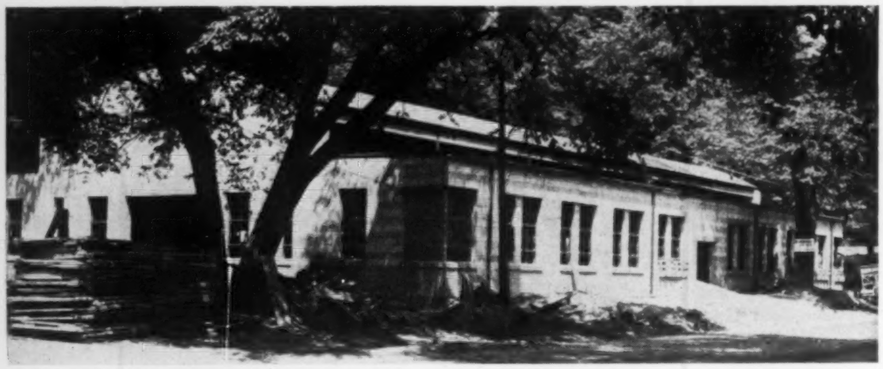
Causes of Harbor Sinking to Be Studied at Stanford

TO DETERMINE WHY land is sinking in the Terminal Island region of Long Beach Harbor, the Stanford Research Institute will make a coordinated overall study of the entire problem, according to a recent announcement from Stanford University. Interested agencies in the Los Angeles area, including the Long Beach Harbor Board, have allocated $100,000 for the study, which will be supervised by Thomas Poulter, associate director of the Research Institute. The actual project leader will be Dr. R. B. Vaile, Jr., who will be assisted by Dr. Karl Terzaghi, Hon. M. ASCE, of the Harvard University faculty, and Dr. Nabor Carillo, of Mexico.

Answers to three major questions will be sought: (1) The cause of subsidence, which in some places amounts to an inch and a quarter a month; (2) the depth at which initial settlement is taking place; and (3) how much sinkage may still be expected. The Institute will use data already collected in studies made by organizations in the area, in addition to developing new methods of gathering needed information.

Such land and offshore stations as are necessary will be set up to measure earth movements, and measurements will be made periodically to establish the horizontal and vertical position of the ground. Special methods will be used to determine at what level in the earth's surface the initial settlement is occurring.

University of Iowa Has New Hydraulics Laboratory Annex



NEW $91,000 ANNEX TO University of Iowa Hydraulics Laboratory, shown in final stages of construction, doubles laboratory facilities of Iowa Institute of Hydraulic Research. Building, housing sediment studies and new air tunnel, is scheduled for occupancy during fall semester. Institute is under direction of Hunter Rouse, M. ASCE.

Meetings and Conferences

American Institute of Chemical Engineers. A meeting of the American Institute of Chemical Engineers is to be held at the Hotel Pennsylvania, New York, N.Y., November 7–10.

American Management Association. Production will be the topic of the American Management Association meeting at the Drake Hotel, in Chicago, Ill., November 18–19.

American Society for Testing Materials. Headquarters for the Philadelphia district meeting of the American Society for Testing Materials will be the Franklin Institute, Philadelphia, Pa., November 10.

American Society of Mechanical Engineers. The annual meeting of the American Society of Mechanical Engineers is to take place in the Hotels Pennsylvania and New Yorker, New York City, November 28 through December 3.

Materials Handling Conference. Sponsored by the Westinghouse Electric Corp., the second Materials Handling Conference is scheduled for the Hotel Statler, Buffalo, N.Y., on November 8–9.

National Exposition of Power and Mechanical Engineering. A long list of innovations designed to improve the performance of power plants is assured for the 18th National Exposition of Power and Mechanical Engineering, to be held in Grand Central Palace, New York, N.Y., November 29 to December 4.

National Research Council. The 28th annual meeting of the Highway Research Board of the Division of Engineering and Industrial Research of the National Research Council will take place in the building of the National Academy of Sciences and the National Research Council in Washington, D.C., December 7–10.

National Warm Air Heating and Air Conditioning Association. The 35th annual convention of the National Warm Air Heating and Air Conditioning Association is to be held at the Hotel Cleveland, Cleveland, Ohio, December 9–10.

Society for Experimental Stress Analysis. Techniques of stress measurement are to be presented at the annual meeting of the Society for Experimental Stress Analysis, which will be held at the Hotel Commodore, in New York City, December 2–4. Inquiries should be addressed to the Society for Experimental Stress Analysis, P.O. Box 168, Cambridge 39, Mass.

New Publications

Hydraulic Engineering. A number of papers presented at the 1948 spring meeting of the Society of Naval Architects and Marine Engineers have been made available in reprint form, and may be obtained from the headquarters of the society at 29 West 39th Street, New York 18, N.Y. Of special interest to engineers will be a paper on "Hydrodynamic Design of the 48-Inch Water Tunnel at the Pennsylvania State College," by Donald Ross, J. M. Robertson, and R. B. Power, and one entitled "The Equipment and Methods Used in Operating the Newport News Hydraulic Laboratory," by C. H. Hancock.

Wood Technology. Technical developments in wood and wood products are summarized in a new and enlarged edition of the Forest Products Research Guide, published by the National Lumber Manufacturers Association. The present edition contains more than 8,000 forest products research projects, including projects of 1,400 domestic and 700 foreign agencies. Copies are for sale at $5 each, from the National Lumber Manufacturers Association, 1319 18th Street, N.W., Washington 6, D.C.

Highways, Louisiana. Tables showing the status of highway construction and maintenance operations, laboratory facilities, and federal aid projects for the state of Louisiana for the years 1946 and 1947 comprise the Fourteenth Biennial Report of the Department of Highways. Inquiries concerning the report should be addressed to the Department of Highways, Baton Rouge, La.

Beach Erosion. Data prepared by members of the staff of the Department of Engineering of the University of California, in connection with contract work done by the department for the U.S. Navy, have been made available in Special Issue No. 1 of the Bulletin of the Beach Erosion Board. These data include a set of 20 graphs expressing various useful wave relationships and tables of functions showing the relationships of the d/L_0 ratio and the d/L ratio to each other and to other determinate features of water waves. Copies of the special bulletin will be furnished free to agencies having need of such data, upon application to the Resident Member, Beach Erosion Board, 5201 Little Falls Road, N.W., Washington 16, D.C.

Steel Products. Two new sections in the Steel Products Manual, which is being issued in installments by the American Iron and Steel Institute, may now be purchased from the Institute, 350 Fifth Avenue, New York, N.Y., at a cost of 25 cents. These are Section 5, dealing with "Steel Sheet Piling," and Section 21, on "Concrete Reinforcing Bars."

Highway Research. Proceedings of the 27th annual meeting of the Highway Research Board—held in Washington, D.C., in December 1947—are now available in book form. The 523-page volume includes a wide variety of papers on the design, construction, and maintenance of highways, traffic studies, and soils investigations. Editors of the Proceedings are ASCE Director Roy W. Crum, director of the Highway Research Board; Fred Burggraf, associate director; and William N. Carey, Jr., Assoc. M. ASCE, research engineer.

Professional Examinations. Solutions to twelve problems, Part II (Basic Engineering Sciences), in the New York State examination for professional engineers, may be obtained from the author, John D. Constance, 625 Hudson Terrace, Cliffside Park 7, N.J., at 50 cents a set. Similar solutions to Part II, July 1948 examinations, are also available at the same price.

Paving Mixes. Technical Memorandum No. 3-254, covering U.S. Waterways Experiment Station investigation of the design and control of asphalt paving mixtures, is now available in three-volume form. Copies may be obtained from the Experiment Station, Vicksburg, Miss., at $1 per volume.

Housing Construction. Numerous booklets have been issued by the Housing and Home Finance Agency as part of its program of making available to the home-building industry the practical results of research projects designed to lower construction costs. The booklets—ranging in subject from the planning of an expansible house (priced at 20 cents) and construction of individual sewage disposal systems (10 cents) to a manual on wood construction for prefabricated houses ($1.50)—may be purchased from the Superintendent of Docu-

Plywood Announcement!

1 **A New, Simplified A-B-C System of Grade Identification for Douglas Fir Plywood Is Now in Effect.**

2 **Douglas Fir Plywood Is Now Produced in Accordance with New U. S. Commercial Standard CS45-48.**

In order to simplify the identification of Douglas fir plywood grades, manufacturers have adopted a new A-B-C system of grade-marking.

Plywood is manufactured in two distinct types—Exterior and Interior. Within each of these two types are several appearance grades. These grades—of either Exterior or Interior type—are determined by the appearance quality of the *outer plys* (face and back veneers).

Now, there are just four such qualities of veneer—A, B, C and D, in order of appearance quality.

Highest in appearance quality — "A" veneer — is that formerly known as "Sound." "B" veneer is a new quality, also known as "Solid," which presents a firm, solid surface, free from open defects. "C" and "D" veneers may contain certain restricted defects which do not affect panel serviceability, and are used where appearance is not important.

GRADES OF EXTERIOR-TYPE

EXT-DFPA•A-A (Sound 2 Sides)
EXT-DFPA•A-B (Sound 1 Side, Solid Back)
EXT-DFPA•PlyShield•A-C (Sound 1 Side)
EXT-DFPA•Utility•B-C (Solid 1 Side)
EXT-DFPA•Sheathing•C-C
EXT-DFPA•Concrete Form•B-B (Solid 2 Sides)

GRADES OF INTERIOR-TYPE

Interior•A-A•DFPA (Sound 2 Sides)
Interior•A-B•DFPA (Sound 1 Side, Solid Back)
PlyPanel•A-D•DFPA (PlyPanel Sound 1 Side)
PlyBase•B-D•DFPA (Solid 1 Side)
PlyScord• C-D•DFPA (Sheathing)
PlyForm•B-B•DFPA (Solid 2 Sides)

The new U. S. Commercial Standard CS45-48 for Douglas fir plywood becomes effective November 1, 1948. The Commercial Standard booklet contains complete data on the new system of grade identification* and new grade-trademarks, and sets forth more stringent performance requirements for Exterior-type plywood. A free copy will be mailed to any point in the United States. Send the coupon below.

Douglas Fir PLYWOOD
LARGE
LIGHT
STRONG **Real Wood** **Panels**

DOUGLAS FIR PLYWOOD ASSOCIATION
Tacoma 2, Washington

GENTLEMEN: Please send me my copy of the new U. S. Commercial Standard CS45-48, which contains new grade designations and new grade-trademarks for Douglas Fir Plywood.

NAME ....
Firm ....
Title ....
Street ....
City .... Zone .... State ....

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*As the new A, B, C, D veneer designations are being introduced, industry grade-trademarking of panels provides for designation either by letters or by previous terminology. Thus, as listed above, grademarks on panels may read either "PlyShield A-C" or "PlyShield SolS" (Sound 1 Side).

ments, Government Printing Office, Washington, D.C.

World Engineering Conference. Bulletins outlining the aims and principal events of the World Engineering Conference, held in Paris in June 1948, have been issued under sponsorship of EJC, by both the French (Bulletin No. 1) and the British (Bulletin No. 5). Copies may be consulted in the Society's Reading Room or the Engineering Societies Library, 29 West 39th Street, New York, N.Y.

Missouri Basin Program. The six-year development program for the Missouri Basin, as revised by the Missouri Basin Inter-Agency Committee to conform to current construction conditions and appropriations, has been released in final form. Copies of the revised program, extending through 1955, may be obtained from the Missouri River Division of the Army Corps of Engineers, Omaha, Nebr.

Wire Reinforcement. Simplified Practice Recommendation R234-48, Welded Wire Fabric Reinforcement for Concrete Pipe, is now for sale by the Superintendent of Documents, Government Printing Office, Washington 25, D.C., at five cents a copy. Discounts of 25 percent will be allowed on orders of 100 or more copies.

Wood Preservation. Standards for treated wood are detailed in a 150-page revised manual of requirements for both heavy and residential construction recently issued by the American Wood Preservers' Association. Inquiries should be addressed to the Association headquarters, 1427 Eye Street, N.W., Washington 5, D.C.

California Engineer Examinations. Addendum 2, containing the 1947 Registered Civil Engineer Examination for California and its solution, is available from the author, A. E. Waegemann, 2833 Webster Street, San Francisco 23, Calif., at 50 cents a copy, postpaid or C.O.D. The series supplements the author's previous book, *California Civil Engineer Registration Examinations and Their Solution,* announced on page 70 of the February issue of CIVIL ENGINEERING.

City Planning. Action taken at the 1947 meetings of the Cleveland City Planning Commission is outlined in a recent mimeographed brochure, entitled *Planning Cleveland 1947*. Inquires should be addressed to the City Planning Commission, Cleveland, Ohio.

Forest Research. Developments in forest research in the Southeast will be summarized briefly in *Research News,* a new monthly publication of the U.S. Forest Service, issued by the Southeastern Forest Experiment Station, Asheville, N.C. The publication will contain abstracts of articles and bibliographies of recent publications in the field.

Engineering Education. Papers presented at the Inter-Professions Conference on Education for Professional Responsibility, held at Buck Hill Falls, Pa., in the spring of 1948 (see CIVIL ENGINEERING for March, page 66, and June, page 71) are now available in anthology form. The 220-page volume, entitled *Education for Professional Responsibility,* may be obtained from the Carnegie Press, Carnegie Institute of Technology, Pittsburgh 13, Pa., at $3 a copy.

Land Surveys. Techniques in the mapping of basic planning data, to aid communities in making land-use surveys or revising their zoning ordinances, are presented in Publication No. 101 of the Public Administration Service, entitled *Mapping for Planning.* Copies are for sale by the Public Administration Service, 1313 East Sixtieth Street, Chicago 37, Ill., at $3.

Engineering Curricula. Activities of the Michigan College of Mining and Technology from the fall of 1941 to the present time are reported in a recent 37-page release of the Michigan College of Mining and Technology, Houghton, Mich.

Housing Trends. Data intended to aid materials' suppliers and builders in capacity and production plants are outlined in *An Analysis of Future Housing Demand,* recently issued by the Producers' Council, Inc. Inquiries should be addressed to the Council, 815 Fifteenth St., N.W., Washington, D. C.

Insulation. Use of cottonseed hulls as an insulating material is advocated in Research Report No. 2 of the Engineering Experiment Station at Texas A. and M. College. The report, which details a cooperative investigation of the Station and the Cotton Research Committee of Texas, may be obtained from the Texas Engineering Experiment Station, College Station, Tex.

Industrial Hydraulics. Proceedings of the Third National Conference on Industrial Hydraulics—held in Chicago in October 1947 under the auspices of the Illinois Institute of Technology and a group of Midwestern societies, including the Illinois Section of the ASCE—are now available in book form. Copies may be purchased from the Armour Research Foundation, Technology Center, Chicago 16, Ill., at $3 each.

Sedimentation Studies. Information on the sediment loads carried by streams in the Upper Mississippi, Ohio, and Great Lakes drainage basins, has been assembled by the U. S. Soil Conservation Service in an effort to reduce costly sediment damages and determine the optimum location for future storage reservoirs. The 40-page mimeographed report, entitled *Rates of Sediment Production in Midwestern United States,* may be obtained from the Milwaukee, Wis., office of the Soil Conservation Service.

Hydraulic Investigations. Issuance of several bulletins outlining current research projects of the Waterways Experiment Station, Vicksburg, Miss., has been announced by the Army Corps of Engineers. These are Bulletin No. 31, *Empirical Verification of Transference Equations in Laboratory Study of Breakwater Stability* (50 cents); Bulletin No. 32, *Laboratory Research Applied to the Hydraulic Design of Large Dams* ($1); and Technical Memorandum No. 2-259, *Plans for Elimination of Shoaling in New Castle-Finns Point Ranges, Delaware River* ($1).

Steel Products. Two more manuals in the series on steel products being issued in installments by the American Iron and Steel Institute are now available from the Institute, 350 Fifth Avenue, New York 1, N. Y., at 25 cents a copy. These are Section 9, covering "Cold Finished Steel Bars and Shafting," and Section 13, on "Cold Rolled Carbon Steel Strip."

Manual on Preparation of Technical Reports Issued

TECHNIQUES OF COLLECTION, assimilation, and analysis of technical material as prerequisites to good report writing are emphasized in a comprehensive 400-page *Manual of Report Preparation* by Frank Kerekes and Robley Winfrey, Members ASCE. Citing reports as standard media of present-day communication, the authors give much valuable information on organization and handling of all types of technical material. Although the importance of clear, concise, and effective expression is stressed, much of the usual academic treatment of English is omitted on the basis that skill in writing is a basic tool already acquired by those who have reached the level of report writing. In the preparation of the book, the authors have drawn on their many years of experience on the civil engineering faculty at Iowa State College.

Copies of the manual may be purchased directly from the publishers, the William C. Brown Co., of Dubuque, Iowa, at a cost of $6 each.

◆

New Magazine Launched by Western Engineers Society

WITH THE ISSUANCE of the September 1948 number of the *Midwest Engineer,* the Western Society of Engineers combines its former publications—the Journal and Bulletin—into a new $8^1/_2 \times 11$-in. format with broader editorial treatment and news coverage. Technical papers of interest to engineers, architects, and others in the scientific fields will be published, as well as articles of more general interest. In addition, the new publication will carry program announcements of the Western Society of Engineers and of other Midwest technical organizations.

◆

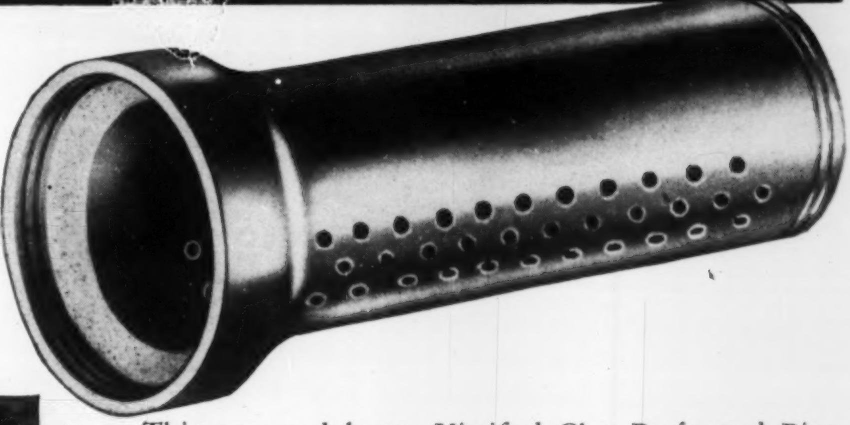
Illinois U. Issues Concrete Floor Construction Pamphlet

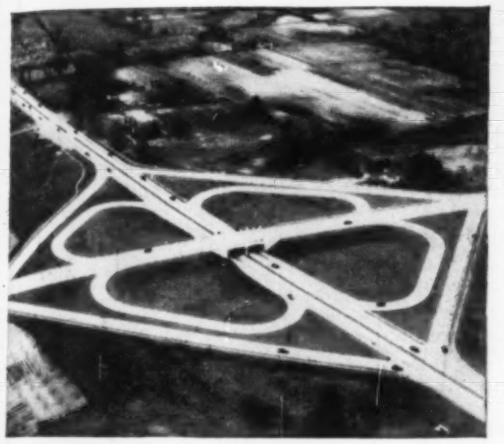
DIRECTIONS FOR BUILDING warm, dry concrete floors for basementless houses are given by the University of Illinois in a four-page circular that may be obtained without charge from the university. Reporting a year of research, during which nine different types of floor slabs were tested, the university recommends: (1) Good drainage, with a 4-in. fill of coarse washed gravel or crushed rock under the floor slab; (2) a vapor barrier, consisting of either a $^1/_8$-in. rigid asphalt board or a reinforced duplex paper with asphalt center, over the fill and extending to the outside edge of the floor; and (3) at least 2 in. of rigid waterproof insulation along the exposed edge of the floor and extending 2 ft under it.

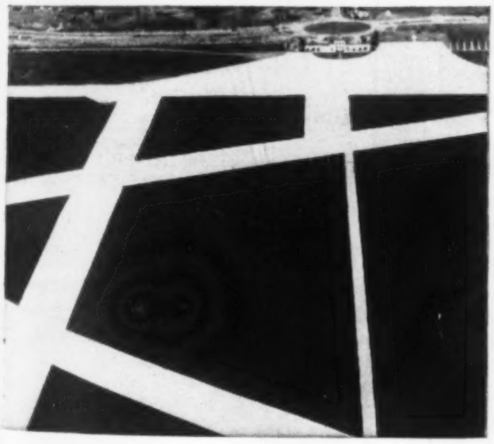
The research project was carried out by the Small Homes Council and the mechanical engineering department of the university, under a cooperative agreement with the U.S. Department of Commerce.

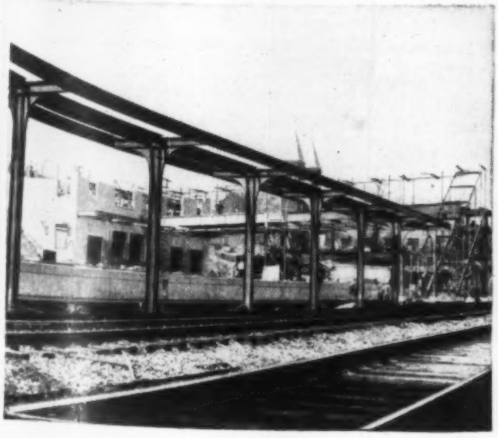
SOMETHING *New* IN UNDERDRAINAGE . . .

IMPROVED PERFORATED CLAY PIPE









This new and better Vitrified Clay Perforated Pipe — now included in A.S.T.M. Standards — was designed as a result of research conducted by the U. S. Engineer Corps, various state highway departments and the Clay Sewer Pipe Association. It is made *especially* for underdrains. The improved design features smaller holes, clean-cut and scientifically placed to handle more ground water, while reducing to a minimum entrance into the line of soil and backfill material. An unobstructed pipe invert is maintained which induces faster flow, more complete drainage.

For Better Drainage . . . Greater Savings Specify A.S.T.M. Perforated Clay Pipe

Improved Perforated Clay Pipe has structural and dimensional specifications identical with A.S.T.M. Designations C13 and C200 for non-perforated Standard and Extra-Strength Clay Pipe, with added requirements for perforations. It conforms to manufacturing standards of the entire Clay Pipe industry, allowing wide application of its special advantages. New Perforated Clay Pipe embodies all the lasting qualities of Vitrified Clay Pipe — strength, durability, and corrosion-resistance. It is the ideal drainage material on projects of every size and nature, both in private and public works. Its many brilliant performance records as a superior underdrainage material for highways, airports, railroads, factories, housing projects and roadways are swinging more and more engineers to this highly efficient drainage pipe.

If you need specific information on a Clay Pipe problem, write the details to the office nearest you.

NATIONAL CLAY PIPE MANUFACTURERS, INC.

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CLAY PIPE

CLAY PIPE NEVER WEARS OUT!

C-1147-14

NEWS OF Engineers

Walter D. Binger, vice-president of the City Investing Co. and president of the City Construction Co., New York, N.Y., has been elected a director of the National Radiator Co.

Fred C. Schlemmer has been named manager of the Hanford (Wash.) Works of the Atomic Energy Commission, succeeding **Carleton Shugg** who becomes deputy general manager for the Atomic Energy Commission, Washington, D.C. Mr. Schlemmer was with the Tennessee Valley Authority from 1933 to 1946, and more recently an executive for the Peerless Woolen Mills company of Rossville, Ga.

Arthur E. Morgan, former president of Antioch College, has accepted an appointment from the Government of India to serve on a nine-man commission to study India's higher education system. Dr. Morgan, a pioneer in progressive education as well as in public administration, flood control engineering and community engineering, will remain in India until next July.

Edward L. Pine is the new secretary-manager of the Nevada chapter of the Associated General Contractors, succeeding **Charles L. Hill,** who had the post from its inception until his recent death. Mr. Pine served in the U.S. Army Engineer Corps during World War II and attained the rank of major.

Emil J. Kaleschke, a city employee of Oakland, Calif., for 24 years, has been appointed administrative assistant to Walter N. Frickstad, city engineer of Oakland, Calif. Mr. Kaleschke will have charge of special projects and will handle applications and negotiations for postwar aid from the state planning funds for construction and purchase of land.

Alfred M. Freudenthal, formerly professor of bridge design at the Hebrew Institute of Technology, Haifa, Palestine, is now a research and design consultant in New York. Dr. Freudenthal had charge of construction of the Tel Aviv port and was consultant to the chief engineer of the British forces in Palestine and Transjordan during the war. He plans to do research work in the Columbia University engineering laboratories this year.

Theodore Belzner, for many years on the maintenance staff of Brooklyn Bridge, was one of the recipients of a "Citation of Service," presented by Deputy Mayor John J. Bennett during a recent New York City Golden Anniversary Exposition ceremony at the Grand Central Palace, "for faithful service to the City of Greater New York at the time of its consolidation in 1898."

Richard G. Coulter, formerly resident engineer and specialist in sewage plants and water systems for Holmes, O'Brien & Gere of Syracuse, has been appointed assistant professor of civil engineering at the Cooper Union School of Engineering. **Joseph S. Ward, Jr.,** and **Milton Alpern** are among the instructors added to the civil engineering staff of the Engineering School.

Ralph W. Kluge has joined the faculty of the Purdue University School of Civil Engineering and Engineering Mechanics as an associate professor of structural engineering, having charge of the instruction and research on reinforced concrete. Professor Kluge has taught at the University of Illinois and more recently was a structural engineer with the National Bureau of Standards.

Alvin Hicks has been made the St. Louis, Mo., sales manager for the Marquette Cement Manufacturing Co., directing sales in Missouri, southern Illinois, and southern Indiana. Prior to his promotion, Mr. Hicks was service engineer and assisted the sales manager in the Memphis, Ga., office of the company.

Frank R. Layng, for the past 48 years with the Bessemer and Lake Erie Railroad Co., Greenville, Pa., in engineering, construction and maintenance work, has resigned as vice-president and chief engineer for the company, but will continue to serve in a consulting capacity. **J. E. Yewell** will succeed him as chief engineer, and **Lewis W. McCoy** as vice-president.

F. J. C. Dresser, formerly president of the Dresser Co., construction engineers, of Cleveland, Ohio, and more recently a member of the Construction Advisory Board of the War Department and consulting engineer for the Mutual Life Insurance Co. of New York, has opened a consulting office at 1737 De Sales Street, N.W., Washington, D.C., where he will be associated with **Robert Leland,** president of Leland, Brinckerhoff & Co., Inc.

Ulric F. R. Grey has been appointed city engineer of Martinez, Calif. He previously served on the city engineer staff in Berkeley, and as city manager of a community in the San Joaquin Valley.

Joseph J. Rosa has joined the Knappen-Tippetts-Abbett Engineering Co. of New York as resident engineer on the New Brunswick, N.J., laboratory. Mr. Rosa was formerly associated with Robert & Co., Inc., architects and engineers of Atlanta, Ga., as their chief civil engineer on Guam.

D. P. Krynine, research associate in soil mechanics at Yale University, is visiting professor of engineering for the University of California. Professor Krynine will spend the fall semester of the academic year at the Los Angeles campus and the spring semester at Berkeley. Professor Krynine has taught soil mechanics at Yale for about 20 years.

Lt. Col. Karl M. Pattee will head the Military Supply and Procurement Office for the Corps of Engineers at New York City, in a civilian capacity. Colonel Pattee served the New England Division of the Corps in Boston, Mass., as executive officer. While overseas, he was engaged in military construction and operations as district engineer in the China-Burma-India theater and as base engineer at Calcutta, India.

Marvin E. Ray resigned as city engineer at Vancouver, Wash., to enter private practice there.

W. Roy Grace has resigned as division engineer for the Oklahoma State Highway Department at Ada, Okla. He is to be succeeded by **Earl Anderson,** who was previously assistant state maintenance engineer.

Reuben F. Leatherwood was recently promoted to the position of chief of the Reservoir Projects Branch, Flood Control Division, Corps of Engineers, at Washington, D.C. Mr. Leatherwood had been chief of the Reports and Data Branch of the same division of the Corps.

E. P. Wiedenhoefer has been made professor of the department of civil engineering of the Michigan College of Mining and Technology. Professor Wiedenhoefer has had considerable field experience with various municipalities and with the Michigan Stream Control Commission, and has been on the Michigan college faculty since 1927.

James H. Le Van is now district engineer of the U.S. Public Health Service at Washington, D.C. In this capacity he relieves **Vincent B. Lamoureux,** who was transferred to the National Security Resources Board, Washington, D.C. Mr. Le Van was previously field coordinator of the Vessel Sanitation Section of the Public Health Service in Washington, D.C.

Charles Macklin is now qualified to practice as an architect as well as a structural engineer in Springfield, Ill.

Randall Cremer, of Ojai, Calif., has accepted a position with the Frederick Snare Corp., New York, N.Y.

Angelo Arnold Dacquisto is now an assistant professor of pre-engineering work at Sampson College, Sampson, N.Y.

Ladislas Segoe, city planner and consulting engineer of Cincinnati, Ohio, has established offices as Ladislas Segoe & Associates in that city.

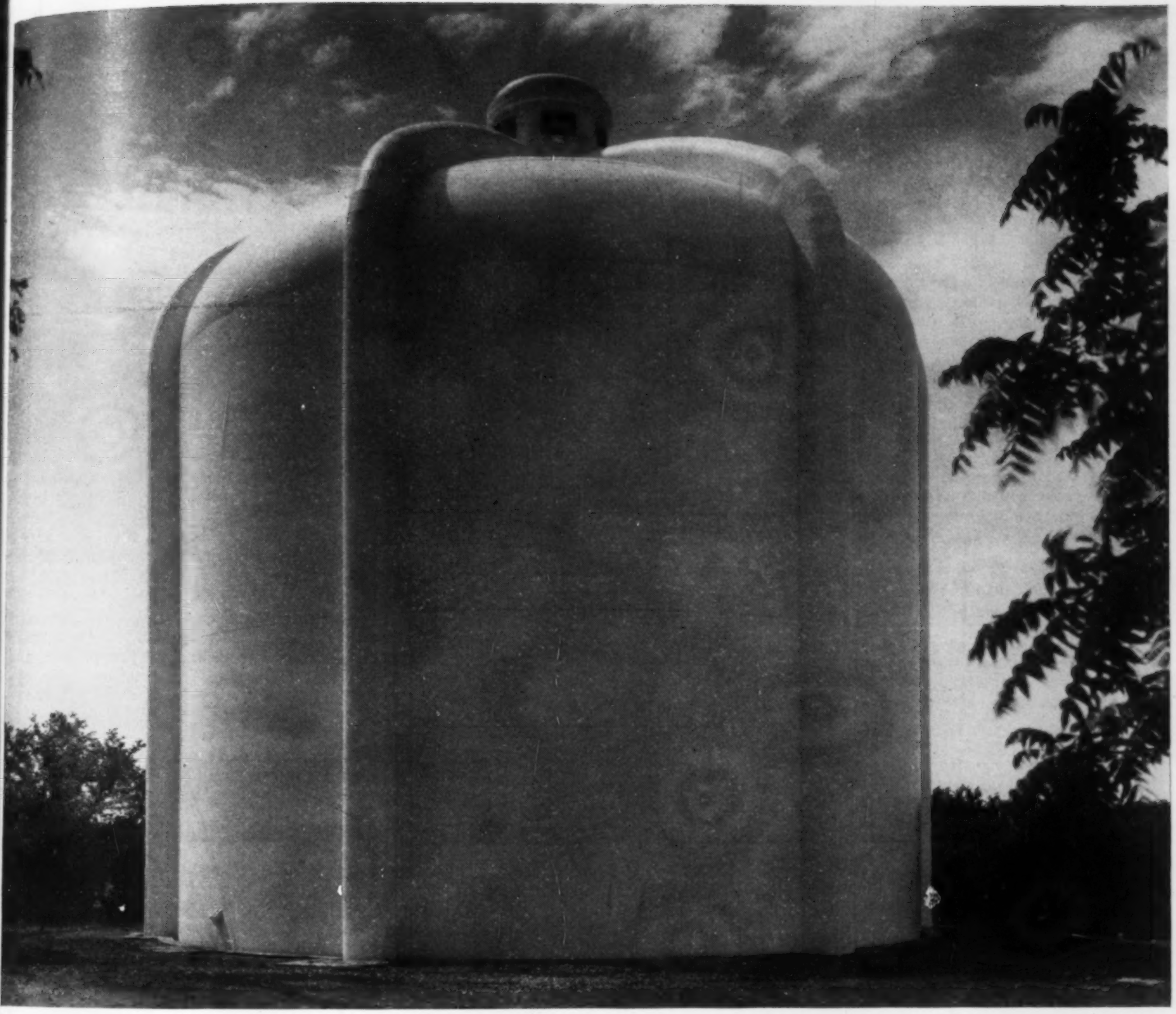
Robley Winfrey, associated with Iowa State College since 1922 as research engineer and bulletin editor, will carry on certain phases of the college program in all areas of transportation engineering, following the resignation of **Prof. Ralph A. Moyer** as professor of highway engineering at Iowa State. Professor Moyer has accepted a position as professor of civil engineering and research engineer in the newly established Institute of Transportation and Traffic Engineering at the University of California (see page 66).

Edward R. Sanner recently resigned from the Tennessee Valley Authority to accept a position as assistant engineer in the district office of the Southern Railroad in Knoxville, Tenn.

Torald Mundal, who has been connected with the Lord Engineering Co., New York, N.Y., has accepted a position with the International Engineering Co., in San Francisco, Calif. Mr. Mundal was at one time design engineer on several Tennessee Valley Authority projects.

Charles H. Torreyson is assuming new duties as sanitary engineer for Owings, Skidmore & Merrill, at Oak Ridge, Tenn., after leaving the Tennessee Valley Authority.

A. L. Pauls, former chief construction engineer for the Tennessee Valley Authority, is now project manager in charge of con-



1,250,000-GALLON STANDPIPE SERVES MANHATTAN

The 1,250,000-gal. Horton standpipe shown above is a welded steel structure which we erected for the city of Manhattan, Kansas. It will provide gravity water pressure to help the city's pumping equipment maintain uniform pressures in the mains and to meet peak loads.

Welded steel reservoirs are practical for furnishing gravity water pressure in a municipal water system where they can be erected on high ground. They have several advantages. Steel will not crack or leak if there is uneven settling. The welded joints are tight and stay water tight. Maintenance costs are low, as regular painting inside and outside keeps the steel in good condition.

Ground level reservoirs are only one of the types of storage tanks we build for municipal water supply systems. Others include Horton elevated tanks and Horton Waterspheres. In many cities, Horton tanks are contributing to better water service and are paying for themselves in relatively short periods of time by increasing the efficiency of pumping equipment and lowering pumping power costs.

For information or estimating figures on steel tank installations, write our nearest office outlining your requirements.

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Atlanta 3..............2167 Healey Bldg.
Birmingham 1.........1596 N. Fiftieth St.
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Detroit 26...........1541 Lafayette Bldg.
Havana..................402 Abreu Bldg.
Houston 2...2128 National Standard Bldg.
Los Angeles 14........1456 Wm. Fox Bldg.
New York 6.....3395-165 Broadway Bldg.
Philadelphia 3,.1652-1700 Walnut St. Bldg.
Salt Lake City 1.1509-1st Security Bk.Bldg.
San Francisco 11.1284-22 Battery St. Bldg.
Seattle 1...............1309 Stuart Bldg.
Tulsa 3.................1647 Hunt Bldg.

Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY and GREENVILLE, PENNA.

struction of Buggs Island Dam for the J. A. Jones Construction Co., of Charlotte, N.C.

Robert E. Hollick, after spending several years in various capacities in Panama, has become associated with the International Engineering Co., San Francisco, Calif.

J. C. Bisset has resigned as director of public works for the City of Dallas, Tex., to join the consulting engineering firm of Ashley G. Classen & Associates, in El Paso, Tex. He will be succeeded by **J. T. Conroy,** on the staff of the Dallas Public Works Department for 32 years—since 1940 as maintenance and construction superintendent.

C. Marshall Jones, Sacramento, Calif., has been made engineer in charge of project planning for the Sacramento Valley district of the Bureau of Reclamation. He will supervise a survey of the water development of the Feather River, investigating the possibilities of three reservoir sites.

L. E. Lippincott, previously bridge engineer for Sacramento, Calif., is now in the Santa Rosa city engineer's office, mapping their water system.

Zint Wyant, Jr., is now associated with Harrison & Cortelyou, consulting engineers, Kansas City, Mo. He was formerly with the Kansas Highway Commission, and more recently with the Capitol Iron Works Co.

W. K. Dinklage, recently made assistant engineer of maintenance for the Kansas Highway Department, moves into the position of assistant engineer of construction, vacated by **K. W. Comfort,** who resigned. Mr. Dinklage has been affiliated with the department in various capacities, including that of resident engineer, assistant division engineer and division engineer. **R. R. Ireland,** formerly division engineer at Salina, will be the new assistant engineer of maintenance.

William N. Evans has been made general manager of the L. E. Dixon Construction Co., of Los Angeles, Calif. Mr. Evans was previously project manager for National Constructors of which the L. E. Dixon Co. is a constituent firm.

John N. Harris has resigned as resident engineer for the Virginia State Department of Highways at Culpeper after 22 years in the department, to join a construction company. He served as a lieutenant colonel in the Army Engineers Corps in World War II.

James A. Darling, of Watrous, Sask., has been appointed Minister of Public Works and Telephones, Province of Saskatchewan, Canada.

E. H. Thomas has resigned as bridge plans engineer for the Montana Highway Department at Helena to enter private consulting engineering practice.

Lt. Col. Sam M. Lipton is now executive officer of the Kansas City District of the Corps of Engineers, succeeding **Lt. Col. Chester L. Landaker,** who has been transferred to the University of Colorado as professor of military science and tactics.

Edwin Fairbairn, for many years county engineer for Sacramento County, has been appointed assistant to Fred J. Klaus, Sacramento city engineer. **Arthur L. Kiefer** will take over the position of county engineer temporarily.

David A. Kosh, of Arlington, Va., is now chief of the Public Utilities Division, Bureau of Federal Supply, U.S. Treasury Department, Washington, D.C. He was formerly senior rate analyst in the Office of Price Administration.

D. V. McCarthy, previously senior engineer in the Office of War Utilities of the War Production Board, is to head the Report Section of the Project Planning Division, Bureau of Reclamation, Washington, D.C.

Deceased

Carl M. Bernegau (Affiliate '03) chairman of the board of Keuffel & Esser Co., manufacturers of engineering and drafting equipment, died at his summer home at Elka Park, N.Y., on September 5. His winter home was in Orange, N.J. Mr. Bernegau, who was 82, was president and treasurer of Keuffel & Esser for many years until failing health forced his retirement from active work a year ago and he was named chairman of the board. During both World Wars his company earned government recognition for its development of submarine periscopes and fire-control instruments.

Virgil Rue Brady (Assoc. M. '25) engineer for the International Boundary Commission at San Benito, Tex., died at Harlingen, Tex., on September 22. Mr. Brady, who was 51, had been employed as an engineer on the construction of the Lower Rio Grande Flood Control Project for the Boundary Commission since 1933. Earlier in his career he was for some years chief engineer for the Trinity Farms Construction Co. at Harlingen.

Charles E. Conover (M. '10) retired engineer of Pearl River, N.Y., died in a hospital in Nyack, N.Y., on September 26. His age was 75. A former division engineer for the New York City Board of Transportation, Mr. Conover was with the city's underground transit system from 1900 until his retirement in 1939.

Frank Harrison Cothran (M. '21) president of the Piedmont & Northern Railway and of the Durham & Southern Railway, Charlotte, N.C., died in a Charlotte hospital on September 1. He was 70. Mr. Cothran had served on many important projects, his positions including resident engineer in charge of the Bridgewater Development for the West Carolina Power Co.; vice-president and general manager of the Quebec Development Co.; construction engineer on the first unit of the Arvida (Quebec) aluminum plant of the Aluminum Co. of America; and vice-president, general manager and chief engineer of the Beauharnois Construction Co. Mr. Cothran had been president of the two railroads since 1937, and had had a consulting practice in Charlotte since 1933. In the latter capacity he served as a consultant on the Bonneville Power Development and the Grand Coulee and Fort Peck projects, and as a member of a board of consultants for the Passamaquoddy Project.

Frank H. Cothran

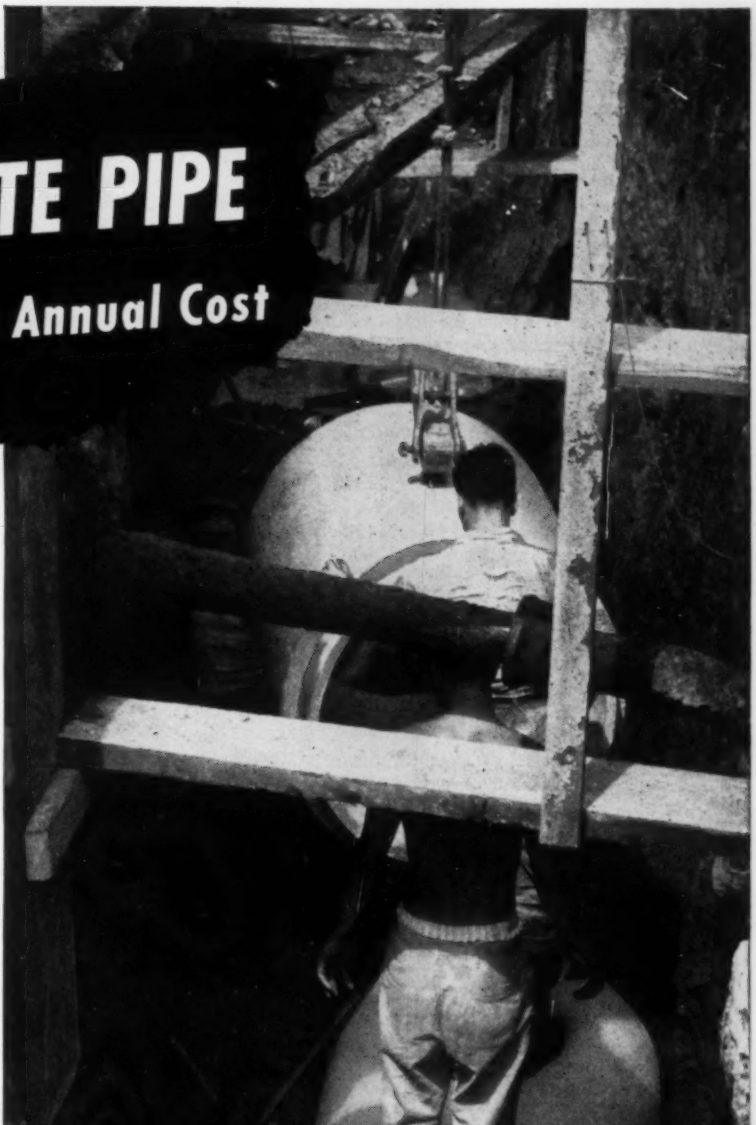
William Tully Dorrance, Jr. (Assoc. M. '40) of Glastonbury, Conn., died in a Bridgeport, Conn., hospital on September 20, from injuries received on September 2, while inspecting a bridge draw at Milford during the course of his work as assistant superintendent of bridges and maintenance for the Connecticut State Highway Department. He was 41. A graduate of Brooklyn Polytechnic Institute in 1931, Mr. Dorrance had had construction experience with C. W. Blakeslee & Sons, New Haven; the Westchester County Park Commission; the Delaware & Hudson Railroad; the American Oil Co., and other industries.

Henry Louis Fruend (M. '25) formerly on the staff of the Tennessee Valley Authority at Knoxville, Tenn., died at Punto Gorda, Fla., on August 12, at the age of 62. From 1918 to 1921 Mr. Fruend was on the staff of the Miami Conservancy District, and from 1921 to 1923 he had a contracting practice in Dayton. He then joined the Fargo Engineering Co., of Jackson, Mich., leaving in 1933 to become a member of the General Engineering Division of the TVA. With the exception of three years as assistant to the director of the Commerce Department, he remained with the TVA until 1947 when illness forced him to retire. Long interested in the Society, Mr. Fruend was a member of the ASCE Committee on Professional Objectives from 1939 to 1942, and served as president of the Tennessee Valley Section in 1937.

Anthony Joseph Gauckler (Assoc. M. '32) engineer of Milwaukee, Wis., died on September 3, at the age of 50. A specialist in the design and construction of school buildings, Mr. Gauckler served as structural engineer for the Milwaukee Board of Education for most of the period from 1925 until his retirement in 1940. Early in his career he was on the civil engineering faculty at Marquette University.

Specify CONCRETE PIPE

for Long Service at Low Annual Cost



FROM coast to coast leading sanitary engineers specify concrete pipe for sewer lines because it meets all essentials of long, dependable, economical sewerage service:

1. **Ample strength** to resist severe impact and to sustain heavy overburdens.
2. **Maximum carrying capacity** and high **wear resistance** to abrasion caused by suspended matter in high velocity flow because of its smooth interior finish and clean, even joints.
3. **Minimum infiltration and leakage** because of tight joints and uniformly dense concrete.
4. **Durability** to render long years of heavy-duty service. This means real ***low-annual-cost*** economy.

Concrete pipe lines for drainage, sanitary sewers and waterlines have demonstrated their superiority in thousands of installations all over America. Many of these lines have served under the hardest usage for half a century and more.

Concrete pipe serves economically because of its moderate first cost, long life and low upkeep. These factors guarantee ***low-annual-cost*** service—the true measure of pipe line economy.

Sanitary sewer being laid in Ridgewood, N. J., a suburban community of 15,000 near New York City.

AMERICAN CONCRETE PIPE ASSOCIATION

228 NORTH LA SALLE STREET, CHICAGO 1, ILLINOIS

George Thomas Gilman (Assoc. M. '29) partner in the New York consulting firm of Moran, Proctor, Freeman & Mueser, died on September 18. Mr. Gilman, who was 46, was an associate engineer with Moran, Proctor, Freeman & Mueser from 1928 to 1940. In the latter year he became chief draftsman for "Dry Dock Engineers," resigning in 1944 to return to the New York consulting organization as a member of the firm. A specialist in foundation work for bridges and skyscrapers, Mr. Gilman was the author of various publications in the field.

Howard Tasso Harper (Jun. '44) civil engineer for the New York Central Railroad at Bellefontaine, Ohio, died at Greensburg, Ind., on August 25 as a result of injuries received in an automobile accident. He was 26, and an engineering alumnus of Ohio State University.

Charles Leonard Hill (M. '46) secretary and manager of the Nevada Chapter of the Associated General Contractors of America, died at his home in Reno, Nev., on August 27. His age was 56. Resident of Nevada since 1923, Mr. Hill was in the state highway department for a number of years. From 1935 to 1939 he served as city engineer of Reno, and he had been secretary-manager of the Nevada chapter of the AGC since its inception in 1941. He was also secretary of the state contractors' board. During World War I, Mr. Hill served overseas with the 18th Army Engineers.

Robert Buck Jeffers (M. '23) retired engineer of Rochester, N.Y., died recently at the age of 64. From 1913 to 1925 Mr. Jeffers was construction engineer for the Eastman Kodak Co., in Rochester, and from 1925 to 1927 he held a similar position with the Northeast Electric Co. In the latter year he became connected with the Rochester Board of Education, serving as senior construction engineer in the Department of Buildings and Grounds until his retirement in March 1948. Mr. Jeffers was a charter member and former president of the Rochester Section of the ASCE, and had served on many committees and in several offices of the Rochester Engineering Society.

Harvey P. Jones (M. '27) senior partner in the firm of Jones & Henry, consulting sanitary engineers of Toledo, Ohio, died on September 24, at the age of 57. Mr. Jones was city sanitary engineer for Toledo in 1916 and 1917, and manager of the Midwest office of Fuller & McClintock from 1918 to 1926. In the latter year he formed his own consulting firm, practicing under the name of H. P. Jones & Co. until 1944 when he entered into partnership with Thomas B. Henry. A specialist in the field of water supply and sewage treatment, Mr. Jones was responsible for the design and construction of the Toledo treatment plant, and shortly before his death had completed plans and specifications for a $7,500,000 extension to the original plant. He was currently serving as vice-president of the Toledo Section of the ASCE, and as chairman of the Ohio Section of the American Water Works Association.

Herbert Clinton Whitehurst (M. '31) director of highways for the District of Columbia, Washington, D.C., died there suddenly on September 1, at the age of 61. Serving overseas as a combat engineer in World War I, Captain Whitehurst remained in the service and, for a time, was head of the construction division of Wilson Dam, Muscle Shoals, Ala. He was transferred to the District Engineer Commissioner's Office in 1926, and three years later was made chief engineer and coordinator. In the latter capacity he originated and directed execution of a plan for streamlining highway management in Washington. Under Captain Whitehurst's administration, the mileage of paved streets in the city was doubled. Long identified with the American Road Builders Association, he served as president in 1935 and 1936 and, at the time of his death, was treasurer. The partly completed K Street elevated highway has been named the "Whitehurst Freeway" in his honor.

H. C. Whitehurst

Harold Todd Livingston (M. '24) chief engineer, maintenance of way and structures of the Chicago, Rock Island & Pacific Railway, Chicago, Ill., died on August 1. Mr. Livingston, who was 59, had been with the Rock Island Lines continuously since 1909. He had held the positions of engineer on maintenance of way, division superintendent, and engineer of bridges, and recently became chief engineer, maintenance of way and structures. During World War I, Mr. Livingston served as captain of the 313th Engineers.

John Coleman Mitchell (Assoc. M. '44) structural engineer for the Public Works Department at the Marine Corps Air Station, Cherry Point, N.C., died at a Naval hospital in Houston, Tex., on September 2. His age was 62. From 1922 until 1942 Mr. Mitchell lived in Houston, where he had a civil engineering practice and served as a manufacturer's agent for building materials. In World War II, he served in Trinidad as a civil engineer at a Navy air base, and from 1943 until shortly before his death he was employed at the Cherry Point base.

John Portman Paget (M. '13) of Guayaquil, Ecuador, died there on August 2, at the age of 74. A native of Harrisburg, Pa., Mr. Paget had been in Ecuador since 1898. He was employed on the construction of the Guayaquil & Quinto Railway, and of more recent years had maintained a construction practice in Guayaquil.

Albert Earl Patterson (Assoc. M. '38) construction engineer for the Public Buildings Administration, Oakland, Calif., died in Berkeley in March 1948, though word of his death has just reached the Society. He was 63. From 1913 to 1925 Mr. Patterso was construction engineer for the Nevada-California Power Co., and since 1926 he ha been with the field force of the Public Buildings Administration.

Carl Edouard Pelz (M. '11) retired engineer of Washington, D.C., died on June 6 at the age of 78. Mr. Pelz spent much of hi early career in railroad work, and from 191 to 1917 he was civil engineer for the secon district of the New York State Publi Service Commission, supervising grade crossing eliminations on the Hudson an Harlem divisions of the New York Centra and for the Long Island Railroad. Fro 1918 until his retirement in 1939 Mr. Pel served, successively, as assistant engineer office engineer, assistant surveyor, and surveyor in the Surveyor's Office of the Distric of Columbia.

Col. Robert A. Radford, (M. '47) adviser on railroads for the American Mission o Aid to Greece, died in Athens on October 6 after a very short illness. He was 60 Colonel Radford was a veteran of both World Wars. His home was in Washington, D.C.

Robert Lynden Schmid (M. '40) chief engineer of the Nashville, Chattanooga & St. Louis Railway, Nashville, Tenn., died o August 21, at the age of 62. Mr. Schmid was in the employ of the Louisville & Nashville Railroad before joining the N.C. & St.L. staff in 1915. During his long tenure with the latter railroad he had served as assistant to the division engineer at Chattanooga; division engineer at Atlanta; assistant to the general manager; and senior assistant engineer. He had been chief engineer for the past ten years.

Reuben Richard Schweitzer (M. '26) president of the Layne-Atlantic Co., Norfolk, Va., died on August 7. Mr. Schweitzer, who was 68, had been president of the Layne-Atlantic Co. since 1926. Earlier in his career he served, successively, as president of R. R. Schweitzer Co.; president of the Schweitzer Machinery Co.; vice-president of the Western Machinery Co.; and vice-president of the Layne-Ohio Co. He was the inventor of a gravel wall water well device.

Walter Gottfrid Stromquist (M. '34) former principal sanitary engineer in the Health and Safety Department of the Tennessee Valley Authority, Chattanooga, Tenn., died on September 11. He was 63. From 1933 until the beginning of this year, when illness forced his retirement, Mr. Stromquist was a sanitary engineer for the TVA, specializing in malaria-control work. Before joining the TVA staff, he had served as sanitary engineer for the U.S. Public Health Service at Muscle Shoals and as director of sanitary engineering for the Memphis, Tenn., and Birmingham, Ala., health departments. Mr. Stromquist was the author of numerous publications in the field of malaria control.

FILTER PLANT GAUGES

ACCURATE, DEPENDABLE

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WASH WATER
10
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INCHES
RISE PER MINUTE
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40
SIMPLEX V&M Co.

Rugged in structure — Pleasing in Design — Sensitive in movement— SIMPLEX gauges are available for—

1. Measurement of Filter Rate of Flow and Loss of Head.

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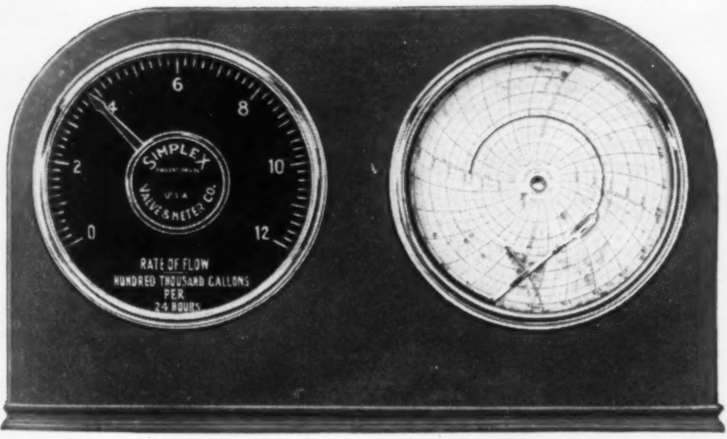
For details write to the Simplex Valve & Meter Company, 6724 Upland St., Philadelphia 42, Pa.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RATE OF FLOW
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24 HOURS

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CONCRETE PAVEMENTS
carry heaviest traffic at lowest maintenance cost

OFFICIAL records of 28 State Highway Departments demonstrate a fact of utmost importance to highway engineers, state and county officials and taxpayers: ***Concrete costs less to maintain than any other type of pavement.***

The records cover 215,166.2 miles of highways in every state reporting maintenance figures by type of surface. Maintenance cost data average 16 consecutive years.

They show that it costs an average of only $109.84 per mile per year to maintain concrete pavement, and $137.54 for the pavement with the next lowest maintenance cost. Of the 12 types of pavements with at least 700 miles in service, the highest maintenance cost was $485.12.

Concrete's low maintenance cost is significant because concrete highways usually carry the largest volume of heavy vehicles.

Low maintenance cost is only one of concrete's advantages. It also:

❶ Is safer. At night concrete reflects the most light, thus increasing visibility. Night or day, wet or dry, concrete's gritty texture affords uniformly high skid resistance.

❷ Usually costs less to build than other pavements of equal load-carrying capacity.

❸ Renders more years of uninterrupted service.

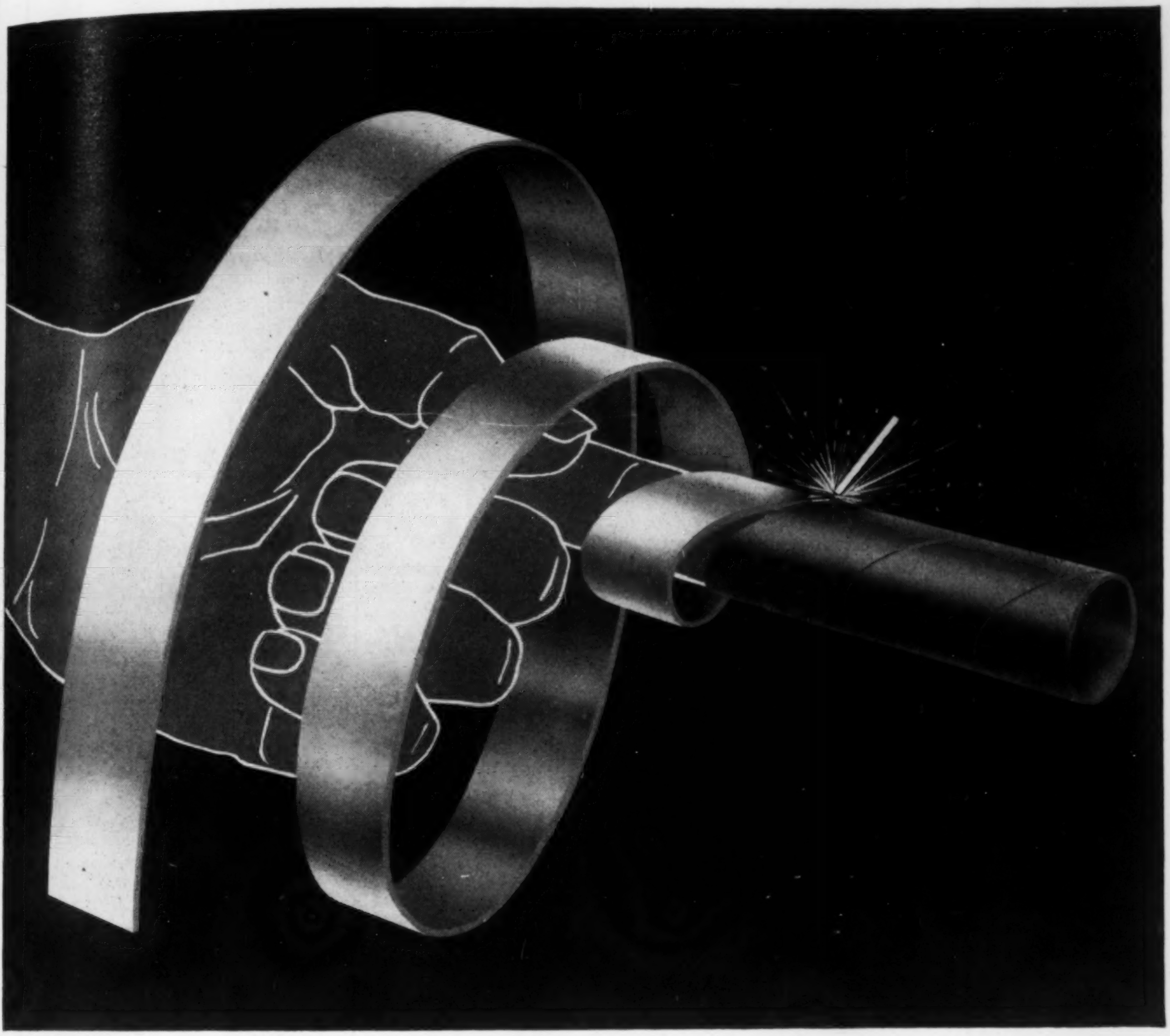
❹ Keeps driving costs low by saving on gas, tires and vehicle repairs.

For more details about pavement surface maintenance costs write for a free copy of "*Road Surface Maintenance Costs from 28 States,*" distributed only in the United States and Canada.

PORTLAND CEMENT ASSOCIATION

Dept. 11-13, 33 W. Grand Avenue, Chicago 10, Illinois

A national organization to improve and extend the uses of portland cement and concrete
. . . through scientific research and engineering field work



It twists steel around its finger

A flat ribbon of steel feeds into an automatic machine. A twist, a weld and it emerges as ARMCO Steel Pipe—one of the world's most efficient pipes for water and gas lines, process piping, foundation piling, dredge pipe, and many other uses.

This ARMCO-developed pipe has special advantages for engineers and contractors. The spiral method of fusion-welding assures exceptional straightness and resistance to external crushing forces—the pipe is uniformly strong. There are no surface defects because the manufacturing processes permit visual inspection of both sides of the pipe wall.

Diameters of ARMCO Steel Pipe range from 6- to 36-inches; wall thicknesses from 9/64- to 1/2-inch. Designers choose exactly the size and wall thickness they need to meet job requirements. Lengths up to 50 feet mean fewer joints to assemble, fewer sections to haul and handle. And ARMCO Pipe can be supplied with a wide variety of coatings and linings as well as standard or special fittings.

These are only a few of the reasons why ARMCO Welded Steel Pipe will save you time and money. Write us for additional information. Armco Drainage & Metal Products, Inc., 2565 Curtis Street, Middletown, Ohio.

EXPORT: THE ARMCO INTERNATIONAL CORPORATION

ARMCO

ARMCO WELDED STEEL PIPE

Elements of Planning A Union Bus Terminal

(*Continued from page 35*)

be enforced so that the docks can be safely operated. The use of crowd control barriers and walkways of sufficient width to handle peak passenger loads should also be carefully investigated. Where a restaurant is contemplated, an appropriately located service area must be provided. Similarly, adequate taxi parking space should be made available.

Experience has indicated that there are few fixed relationships between the various elements and areas of bus terminals. Each development must be designed in accordance with the nature and peculiarities of the traffic it is intended to serve. Facilities such as waiting rooms, ticket offices, restaurants, rest rooms, baggage rooms, etc., are all part of the modern terminal. Nevertheless, the extent and nature of the facilities provided by a particular depot will, in general, depend directly upon the amount of traffic that is to use the facility, and indirectly upon the size of the city. In small cities the revenue problem is of considerable importance, and tends to control the design since ticket sales alone will not maintain the terminal on a self-sustaining basis. Consequently the terminal should incorporate additional revenue-producing facilities.

On the other hand, for large cities with considerable bus traffic, the correspondingly higher revenues will tend to maintain the terminal and hence subordinate the importance of facilities producing additional income. It should be borne in mind, however, that although supplementary revenue-producing facilities are highly desirable, the primary function of this type of structure is to handle bus and passenger traffic at a terminal point, and all features of design should proceed toward the achievement of this fundamental requirement.

◆

Hospital Construction for Leper Colony Poses Problems

(*Continued from page 30*)

The construction work was broken down into small subcontracts for labor whenever possible and only miscellaneous work was done by force account. Camp facilities were made available to all workmen desiring them whether subcontractor's employees or those directly employed by the Servicio. All personnel were provided with their midday meal and all but those living in the vicinity were housed in the camp. All materials for the work were furnished by the Servicio as well as most of the tools. Since most of the subcontracts were let to enterprising craftsmen without capital it was necessary to make frequent partial payments to permit them to meet their payrolls. Such payments were made possible through an arrangement with a merchant in Sapucay who honored vouchers issued by the Project Superintendent and was reimbursed monthly. The arrangement avoided the keeping of large amounts of cash at the camp and provided a readily accepted means of payment.

Of the $80,547.99 spent on this project, $36,334.70 or 45.1 percent was spent for labor, materials, and equipment used in the construction of the hospital and $11,379.99 or 14.1 percent was spent for water supply facilities. Thus a total of 59.2 percent of the funds appropriated was spent directly on the job. The remaining 40.8 percent, or $32,833.30, was spent as follows:

ITEMS	AMOUNT	PERCENT
General administration and social security	$ 8,948.34	11.11
Construction and operation of brickplant	3,291.39	4.09
Engineering design	731.26	0.91
Construction administration .	6,811.13	8.46
Construction camp and maintenance.	6,156.27	7.64
Transportation	6,894.91	8.57
Total.	$32,833.30	40.8

◆

Staten Island Terminal for Ferry, Bus and Rail Transport

(*Continued from page 26*)

for proper track curvature for passenger service from the new terminal to the South and East Shore Lines and to accommodate the relocated main-line tracks. The limited space between the bulkhead and the retaining wall inshore, as previously pointed out, has made it necessary to reduce the area formerly used for rail facilities. Consequently a certain amount of squeezing has been necessary in developing a track layout. This squeezing has made it necessary to extend into the tunnel part of the switching facilities from main-line tracks to passenger terminal tracks.

Construction completed to date includes the two ferry slips and temporary passenger waiting-room facilities for the 69th Street Brooklyn Ferry. These two slips contain 90,000 lin ft of treated timber piles, 23,000 fbm of treated timber and lumber, 22,000 lin ft of oak piles and 270,000 fbm of oak timber and lumber. Approximately 45,000 tons of stone riprap were placed for the support of the ferry racks.

Other work that has been completed in the easterly area includes temporary approaches and permanent subsurface utilities; also a steel sheetpile and concrete bulkhead wall extending for a distance of 1,175 ft, with 173,000 cu yd of fill placed behind it.

Driving of foundation piles for the approach structures and the terminal building is under way and test loading of some of the piles is in progress. Rapidly nearing completion on the westerly side is the North Vehicular Ramp, a viaduct structure which spans the yards of the Staten Island Rapid Transit Railway and connects the westerly entrance and exit road to the terminal with the highway known as Richmond Terrace. The viaduct contains about 450 tons of structural steel, 100 tons of reinforcing steel and some 3,000 cu yd of concrete.

Work is also under way on widening of highway approaches to the terminal area. Completion of the major part of the project in usable form is planned for late 1949, and completion of the entire project for 1950.

◆

Soil Mechanics Group Hears Rotterdam Conference Reports

(*Continued from page 23*)

soft and compressible clays. For most other clays discussions of variations of strength with stress are almost exclusively academic because their effective practical strength is their natural density strength or their strength along planes of greatest weakness. These procedures also are not applicable to partially saturated clays but have been shown to apply to artificially compacted clays after saturation."

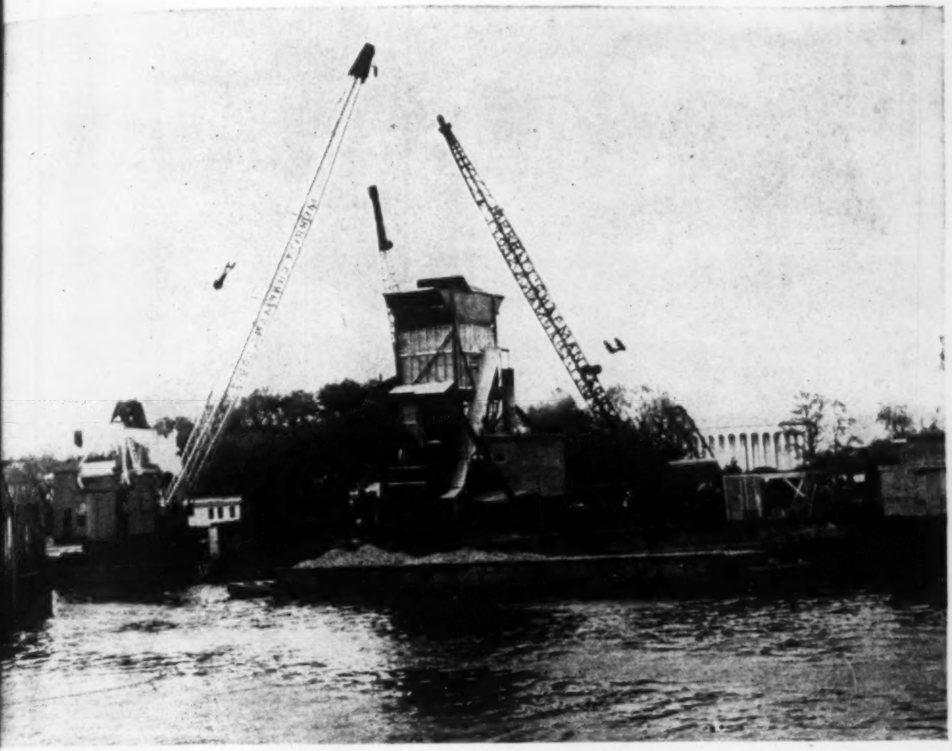
Thomas A. Middlebrooks

In his paper, Mr. Middlebrooks reported on the subject of stability and deformations of earth construction as discussed at the Rotterdam Conference. Summarizing, Mr. Middlebrooks said:

"Pore pressure in soil masses and its effect on stability was by far the most important subject covered and the one which received the most attention. Several examples of flow slides were given, but the solution of this problem was not evident. The circular arc method of stability analy-

(*Continued on page 84*)

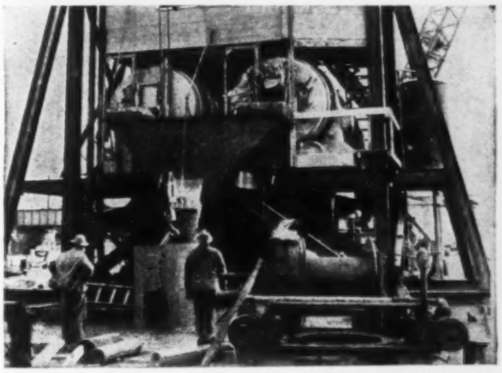
Helping to Throw a Bridge Across The Potomac



erritt-Chapman & Scott's "concrete fleet", showing the Blue Brute mixing plant and attendant barges.

rete for the piers of the new Washington-ndria bridge over the Potomac is being d on a unique floating batching and mix-lant employing two Ransome Blue Brute Mixers. Merritt-Chapman & Scott, Corp. ractors, combined a mixing and batching t with a floating crane to keep the plant the forms. Cement, sand, and aggregate upplied from barges hauled to the plant, mixed concrete is hoisted by floating e to the forms.

ch one of these Blue Brutes is equipped the new Ransome "power pack"—a small, pact unit containing the discharge mecha-'s automatic hydraulic control, allowing man operation with a single handlever.



Aboard Merritt-Chapman & Scott's floating mixing plant on the Potomac. Mixers are Ransome Blue Brutes, Model 56S.

uts in a Good Dig For New Housing

e's a new housing project in West Orange, Jersey, and the Commonwealth Water pany—already serving a population of 000 in three New Jersey counties—is lay-pipe to supply its water needs.

complete the job in the fastest possible , the contractor, W. G. Fritz Construction pany of West Orange, uses Worthington Brute construction equipment. The pho-phs show a Blue Brute Portable Air pressor supplying air for rock drilling.

Worthington Blue Brute Air Compressor supplying air for rock drilling.

NEWS

FROM THE PUBLIC WORKS FRONT

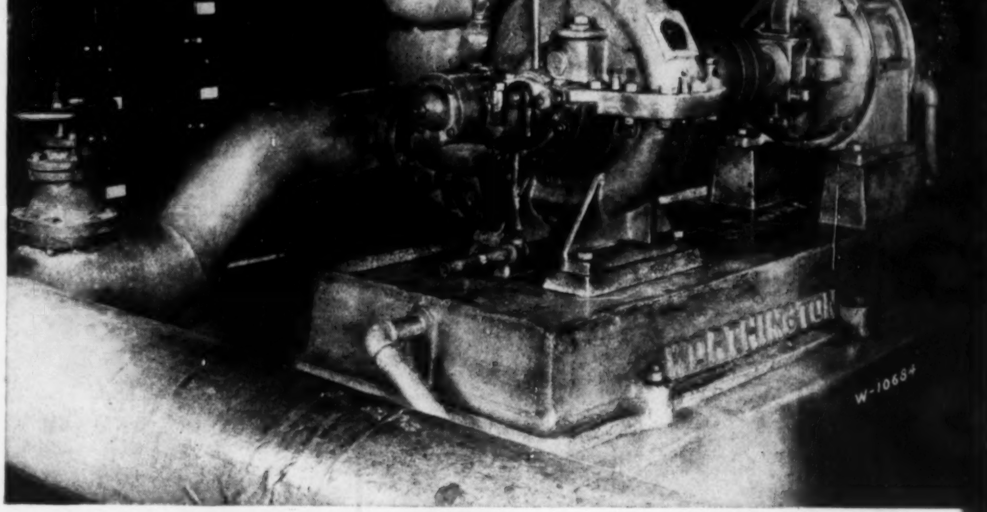
AS REPORTED BY THE DEVELOPMENT ENGINEERS, FIELD SERVICE REPRESENTATIVES AND CUSTOMERS OF WORTHINGTON

1

RTHINGTON PUMP AND MACHINERY CORPORATION, HARRISON, N.J. ◆

NEWS

from the public works front



Worthington centrifugal pump handling entire water supply at Mutual Benefit Insurance Company, Ne

This Pump Turned Out To Be Good Insurance

21 years ago a 3-inch SD centrifugal pump was installed by Worthington at the home office of the Mutual Benefit Life Insurance Company, Newark, N. J.

Its job is to transfer city water from a reserve tank in the engine room to a penthouse tank, which supplies all the water needs—drinking fountains, washrooms, laundr taurant—for approximately 1000 worke

Mr. J. Shearer, chief engineer, infor that in its 21 years in service, this Wor ton pump has never required repair, for repacking!

Largest Dual Fuel Engine Contract Awarded to Worthington

Power for operating the new $42,000,000 Hyperion-Activated Sludge Plant now being built for the City of Los Angeles, will be supplied by five SEHGO-8 1688 hp Worthington Dual Fuel Engines direct-connected to Electric Machinery Company generators. Four additional Worthington engines of the same size and type will supply power for operating four 40,000 cfm centrifugal compressors, thr step-up gears.

The compressed air is used for supp air to the aeration tanks in the activated s process for biological treatment.

The contract for Worthington engine e ment for this plant is the largest for thi of service ever to be awarded in the w

public works NEWS

Worthington Pump and Machinery Corporation

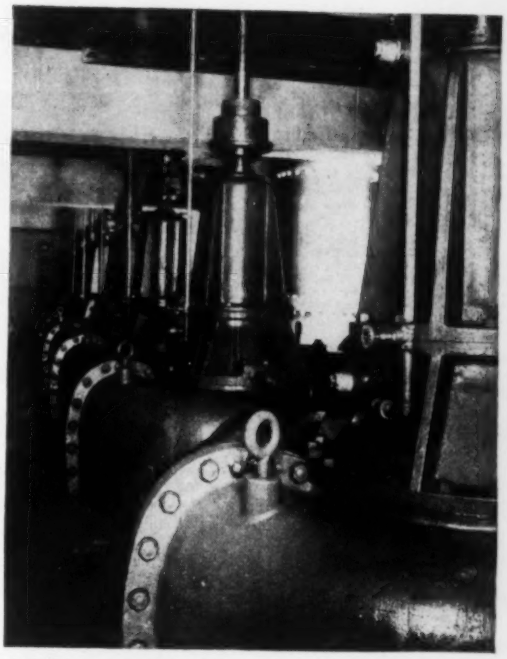
•

Harrison, N. J.

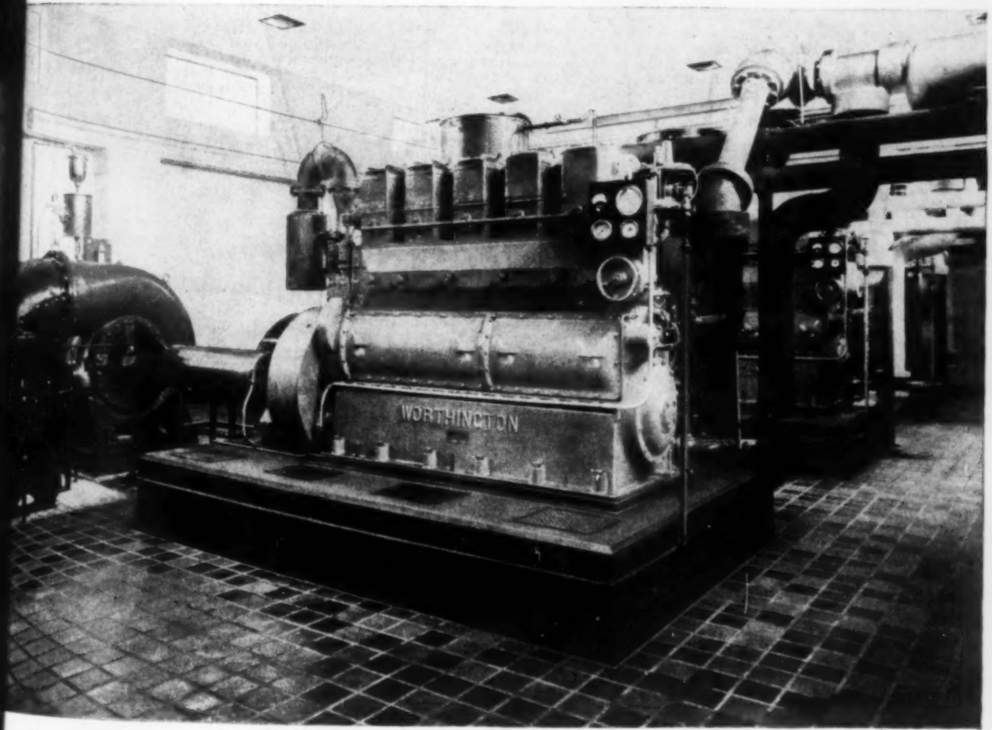
Kept Calm hrough Years of Storms

n 30-MC-2 Worthington Vertical Volute lo Pumps used for pumping storm water e City of Rock Island (Ill.) Sewage Dis- l Works have been on the job for eight s.

r. C. G. Durkee, chief operator, states: "It t interest you to know that in the eight s that these pumps have been in service e has never been one minute delay in their ation, and with the exception of repack- each pump once there has been no other tenance or repair other than lubrication."



Worthington Vertical Volute Mixflo Pumps in sewage plant at Rock Island, Ill.



Worthington 175 hp gas engines driving 20 mgd pumps.

Rosy Picture at Gary Sewage Plant

ords of sewage treatment at Gary, Ind. for 7 show highly gratifying results—new rds for solids removal and second best ly showing in oxygen-demand reduction hile handling the fourth largest volume. hree 20 mgd Worthington pumps lift the sewage into grit chambers where it flows by gravity through the rest of the plant. The Worthington pumps are driven by 175 hp Worthington gas engines. Daily average was 19.9 mgd.

3

Soil Mechanics Group Hears Rotterdam Conference Reports

(*Continued from page 80*)

sis was generally accepted for determining the stability for most conditions. However, an application of the elastic theory was presented, which has considerable merit for special cases."

Willard J. Turnbull

Covering the developments in laboratories and laboratory investigations as presented at the Rotterdam Conference, Mr. Turnbull reported on a number of papers presented in this field, covering a wide variety of methods and opinions, and reviewed the present status and trends of laboratory investigations.

Frank A. Marston

Reporting on the attention given by the Rotterdam Conference to improvement of mechanical properties of soils by mechanical methods, Mr. Marston discussed 14 papers presented in this section and one of related interest dealing principally with the compaction of soil for rolled-fill earth dams and for the subgrades of pavements or other structures. The papers dealt largely with the development of better methods of laboratory and field control over soil compaction and the selection and operation of equipment to obtain the desired degree of compaction needed for stability and other characteristics. Apologizing for the necessary brevity of the references covered in his paper, Mr. Marston concluded:

"It is hoped that attention may have been drawn to the Conference proceedings as a whole, because they contain many papers of great interest and importance in the field of soil mechanics."

◆

Recent BOOKS

ELEMENTARY STEAM POWER ENGINEERING, 3 ed. By E. MacNaughton. John Wiley & Sons, New York; Chapman & Hall, Ltd., London, 1948. 640 pp., illus., diagrs., charts, tables, $9^{1}/_{4} \times 6$ in., cloth, $6.50. This book presents in a clear and concise manner the fundamental principles underlying the construction and operation of steam power plants and equipment. New data on thermodynamic principles, turbine, and boilers have been added to this edition, while the remaining material has been thoroughly revised and brought up to date. Practical applications have been introduced before theroretical aspects.

FUNDAMENTALS OF CIVIL ENGINEERING. By J. K. Minasian. School of Applied Engineering, 233 So. Broadway, Los Angeles 12, Calif., 1945. Paged in sections, $10^{3}/_{4} \times 8^{1}/_{4}$ in., photo-offset, stiff paper, $3.00. Following 16 lectures on the various phases of civil engineering covered by the California State Board of Registration are 107 practice problems. The appendix contains copies of the examinations given from May 1945 through June 1948.

(A) GUIDE TO TECHNICAL WRITING. By W. Crouch and R. L. Zetler. Ronald Press Co., N York, 1948. 401 pp., illus., diagrs., charts, tabl $9^{1}/_{2} \times 6$ in., cloth, $4.00. This book covers b the techniques of various kinds of communi tions and the principles of writing. The busin letter, technical article, report, abstract, a types of oral communication are considered in t first section. The chapter, "Language Ess tials," reviews the fundamental principles. T "Index to English Usage" which follows has be arranged alphabetically and has been limited essentials of English and grammar which tec nical men must employ. Throughout, the sty has been kept informal, even conversational.

LA FATIGUE DES METAUX, 3 ed. By R. Caza preface by A. Caquot. Dunod, 92 Rue Bo parte, Paris, 1948. 318 pp., illus., diagrs., char tables, $9^{1}/_{4} \times 6^{1}/_{4}$ in., paper, 1,650 frs. T theory and characteristics of fatigue failure metals are discussed in the light of recent velopments in the field. Methods and machi for fatigue testing are described, and the influe of various factors on fatigue is considered. Se rate chapters are devoted to the resistance joints and machine assemblies to fatigue, and the improvement in endurance of machine par Fatigue values for a large number of metals a alloys are given together with graphs and tabl

SOIL PHYSICS. By L. D. Baver. 2 ed. John Wi & Sons, New York; Chapman & Hall, Lt London, 1948. 398 pp., illus., diagrs., char tables, $9^{1}/_{4} \times 5^{3}/_{4}$ in., cloth, $4.75. A clear a readable treatment of both the fundament and applied aspects of soil physics. The bo emphasizes recent developments in the fie starting with the basic make-up of the soil a continuing with the physical properties of t various soil components. New material has be added on electron micrographs and the shape clay particles, the effect of micro-organisms soil structure, raindrop effects on soil erosi and the chapter on soil water has been enlarge One feature is a key to the French, German, a Russian literature on the subject.

SUBSTRUCTURE ANALYSIS AND DESIGN. By Andersen. Irwin-Farnham Publishing C Chicago, Ill., 1948. 305 pp., illus., diag charts, tables, $9^{1}/_{4} \times 6$ in., cloth, $4.50. E phasizing solutions to the problems of the d signing engineer, this text deals exclusively wi the analyses and designs of those portions of structure which are located below the surface the ground, water, or both. The first chapte are devoted to methods for evaluating late earth pressures with direct applications of th theories to the design of flexible bulkheads. T material on soil bearing power deals with allo able soil pressures. Another chapter discus the current practice in footing design. Piles a groups of piles are considered at length. The la seven chapters present specialized phases of su structure analysis, extending into the fields pier, dock and breakwater design.

CHANGES IN MEMBERSHIP GRADES

ADDITIONS, TRANSFERS, REINSTATEMENTS, AND RESIGNATIONS

From September 10 to October 9, 1948

Additions to Membership

ABIDI, ASGHAR ALI (Jun. '48) (Res., 2500 Norfolk Rd., Cleveland Heights, Ohio.)

AGHBABIAN, MIHRAN S. (Jun. '48) Graduate Student & Teaching Assistant, University of California, International House, Berkeley, Calif.

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ANDERSON, ROBERT RAY (Jun. '48) Engr., P-1, Bureau of Reclamation (Res., 490 So. Clay St.), Denver, Colo.

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BASSETT, EDWARD MORRIS, JR. (Jun. '48) Engr. (Project Engr. Section), E. I. duPont Co., R.D. #2, Seaford, Del.

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(*Continued on page 90*)

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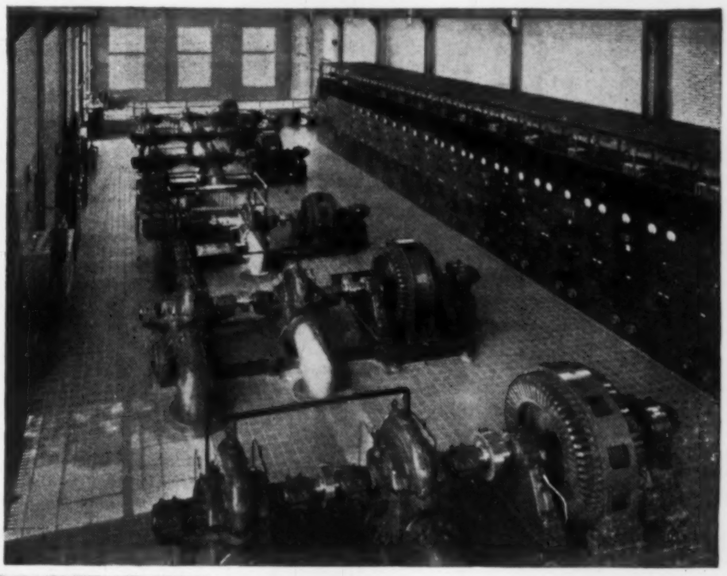
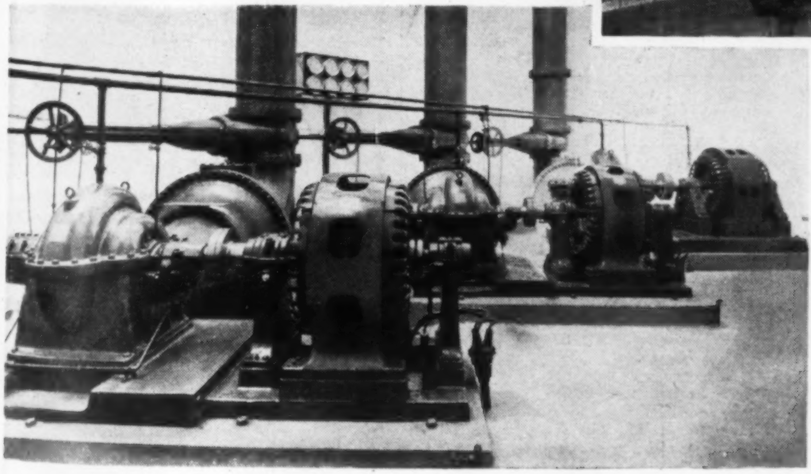


MAIN PUMPING FLOOR of the 120 mgd Bachman Waterworks, City of Dallas, Texas. This plant has 15,225 hp in Westinghouse motors, supplemented by Westinghouse switchgear and other apparatus. The satisfactory service rendered is evidenced by 12 years' operation without repairs of any kind to electrical equipment, with a maintenance cost which has averaged less than 2c per hp.

In the center are five 800-hp and one 400-hp Westinghouse synchronous motors. At the left and right-rear two Westinghouse motor generator sets (one of which is a standby unit) furnish excitation for four 500-hp and three 900-hp Westinghouse motors located in the basement. At the right is shown part of the Westinghouse controls for the entire plant



LEFT: Basement floor, showing three of four 500-hp Westinghouse motors, each of which drive a 30 mgd raw-water pump. Three 900-hp Westinghouse vertical motors, driving clear-water pumps, are also located on this floor but are not seen in this picture

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Merjan, Stanley (Jun. '48) Junior Civ. Engr., New York City Board of Water Supply, Downsville, Delaware Co. (Res., General Delivery), Downsville, N.Y.

Merrill, Robert Arthur (M. '48) Consulting Engr., Room 423, Hamilton Bank Bldg., Chattanooga (Res. 204 Franklin Rd., Lookout Mountain), Tenn.

Miller, Viggo (Assoc. M. '48) Structural Engr., Ozark Dam Constrs., Care Ozark Dam Constrs., Mountain Home (Res., P.O. Box 29, Cotter), Ark.

Millner, Lawrence Benjamin (Jun. '48) Salesman,The Frank Millner Co., 102 No. Olden Ave., Trenton, N.J.

Mitnick, Mitchell (Jun. '48) Draftsman-Designer, The Ballinger Co., 121 No. Broad St. (Res., 5138 Gainor Rd.), Philadelphia, Pa.

Morris, Edgar Longette (Assoc. M. '48) Partner, McLain & Morris, Attorneys, 910 Liberty Life Bldg., Columbia, S.C.

Muchow, Robert Leonard (Jun. '48) Estimating Engr., Carrothers Constr. Co., Box 350 (Res., 313 No. Pearl), Paola, Kans.

Murphy, Walter Dewitt (Jun. '48) Instructor, The Rice Institute (Res., 1121 Banks, Apt. #2), Houston, Tex.

Nagler, Bruce Edwin (Jun. '48) Junior Engr., Town of West Springfield, Town Hall (Res., 144 Woodmont St.), West Springfield, Mass.

Nathanson, Solomon (Assoc. M. '48) Constr. Engr., Henry Nathanson & Son, 376 Clarke Ave., Westmount (Res., 3475 Van Horne Ave., Montreal), Quebec, Canada.

Nelson, Roger James (M. '48) Civ. Engr., U.S. Forest Service, Missoula, Mont.

Nicholson, Leland Wesley (Jun. '48) Draftsman "B," Carnegie-Illinois Steel Corp., Gary Works (Res., 1130 W. 7th Ave.), Gary, Ind.

Novick, David Aaron (Jun. '48) Junior Civ. Engr., New York City Board of Water Supply, Lackawack (Res., 2234 Ocean Ave., Brooklyn), N.Y.

Nowell, John Turner (Jun. '48) Student Engr., New Jersey Bell Telephone Co., 16 N.W. Blvd. (Res., 717 Almond St.), Vineland, N.J.

Nyman, Frank Edmond (Jun. '48) Res. Engr., Morrison Eng. Co., Civ. Center, Helena (Res., 816 W. Evelyn, Lewistown), Mont.

Paddock, Eric "C" (Assoc. M. '48) Secretary-Treasurer, The Ballard-Paddock Co., 415 Equitable Bldg., Baltimore, Md.

Pearce, Ralph Maynard (Jun. '48) Engr., Wayne County Road Comm., Barlum Tower, Detroit (Res., 1122 Hoffman, Royal Oak), Mich.

Peterson, George Alfred (Jun. '48) Structural Steel Draftsman, Mosher Steel Co., Washington Ave. (Res., 3912 Bute St.), Houston, Tex.

Peterson, Loyd Edwin (Jun. '48) Civ. Engr., Eby Constr. Co., Inc., 610 No. Main, Wichita (Res., 107 Mass. Ave., Kinsley), Kans.

Pickett, Andrew Greer (Jun. '48) Eng. Asst., Urban Expressway, Texas Highway Dept., San Antonio (Res., Floresville), Tex.

Quintus duToit, Daniel Francois (Assoc. M. '48) Town Engr., Beaufort West Municipality, P.O. Box 9, Beaufort West, South Africa.

Reed, Oscar Lee (Assoc. M. '48) Owner, O. L. Reed, Contractor & Engineer, Wynnburg, Tenn.

Reily, Howard Merlin (Jun. '48) Senior Laboratory Asst., Texas Highway Dept., 1635 No. Main, Paris, Tex.

Rhoads, Donald Eugene (Jun. '48) Asst. Constr. Engr., W. R. Holway & Associates, Consulting Engrs., 302 E. 18th St., Tulsa (Res., 309 So. Foreman, Vinita), Okla.

Riedel, Alan King (Jun. '48) San. Engr., Barker & Wheeler, Engrs., 36 State St., Albany, N.Y. (Res., 282 Main St., Easthampton, Mass.)

Ritter, Anderson Basil (Assoc. M. '48) Regional Engr., Louisiana State Health Dept., Box 576, Lafayette, La.

Robbins, James Melvin (M. '48) Exec. Assoc. Civ. Engr., Newark College of Eng., 367 High St. (Res., 83 Maplewood Ave.), Maplewood, N.J.

Roberts, John Morris (Jun. '48) Civ. Engr. Bureau of Reclamation (Res., Box 422), Trenton, Nebr.

Robillard, Robert Joseph (Assoc. M. '48) Engr. & Treas, Checkley Contr. Inc., 147$^1/_2$ So. Front St. (Res., 237 High St.), Benton Harbor, Mich.

Rogness, Aaron Nicholas (Jun. '48) Civ. Engr., P-1, Corps of Engrs., Pickstown (Res., Pickstown), S.Dak.

Roth, Aaron (Assoc. M. '48) Gen. Mgr. & Constr. Engr., Roth-Buerman Co., 319 Mt. Pleasant Ave., Newark, N.J. (Res. 1680 Metropolitan Ave., N.Y.)

TOTAL MEMBERSHIP AS OF OCTOBER 9, 1948

Members	7,185
Associate Members	9,246
Corporate Members	16,431
Honorary Members	40
Juniors	7,523
Affiliates	73
Fellows	1
Total	24,068
(October 9, 1947	21,901)

Ruble, Emerson Jonah (M. '48) Structural Engr., Research Staff, Association of American Railroads, 59 E. Van Buren, Ill.

Rust, Quentin (Jun. '48) Field Engr., Portland Cement Association, 816 W. 5th St., Los Angeles, Calif.

Salmond, William Alfred (Jun. '48) Engr., Salmond Scrimshaw Constr. Co., 526 Elm St., Arlinton (Res., 45 Park Ave., Apt. 103, Verona), N.J.

Satterfield, Claude Russell (Jun. '48) P-1, Care, U.S. Bureau of Reclamation, Kortes Dam, Wyo.

Schumm, Walter Richard (Jun. '48) (Res., 501 Martense Ave., Teaneck, N.J.)

Seaborn, Louis Augustus (M. '48) I.E. Morris & Associates, P.O. Box 788, 151$^1/_2$ Nassau St. N.W., Atlanta, Ga.

Secof, Samuel (Jun. '48) Junior Civ. Engr., California State Bridge Dept., Wilcox Bldg. (Res., 162 So. Hayworth Ave.), Los Angeles, Calif.

Seifert, Abe (Jun. '48) Senior Draftsman, E. B. Badger & Sons Co., 75 Pitts St. (Res., 315 Huntington Ave.), Boston, Mass.

Sherman, Daniel Charles (M. '48) Jensen Bowen & Farrell Engrs., 209 Michigan Theatre Bldg., Ann Arbor, Mich.

Sjunnesson, J. Edward (Jun. '48) Field Service Engr., A. M. Byers Co., 135 So. LaSalle St. (Res., 30 West Chicago Ave.), Chicago, Ill.

Skogstad, Leif (Jun. '48) Draftsman & Junior Designer, J. M. Montgomery & Co., 306 W. 3rd St., Los Angeles (Res., 1322 Oak St., Santa Monica), Calif.

Slotnick, Soloman (Jun. '48) Layout Engr., Hunt Eng. Co., Teaneck (Res., 95 Clinton Pl., Newark), N.J.

Slovenko, Ralph (Jun. '48) Supervisor, Apt. Constr., Shelby Constr. Co., 4400 Paris Ave. (Res., 2529 Jefferson Ave.), New Orleans, La.

Smith, Andrew L. (Jun. '48) Field Engr. (Civ.), The California Co., Box 58, Washington, Miss.

Smith, Ernest Karl (M. '48) Asst. Civ. Engr., Eastman Kodak Co., (Res., 119 Chadwell Rd.), Rochester, N.Y.

Sowle, John Schermerhorn (Assoc. M. '48) Structural Engr., Drake Puget Sound, 2801 16th Ave., S.W. (Res., 6815 26th Ave., N.E.), Seattle, Wash.

Steele, James Polk (M. '48) President, J. P. Steele Constr. Co., 617 Grand Ave., Laramie, Wyo.

Stevens, Charles Stephen (Assoc. M. '48) Hydraulic Engr., Board of Water Engrs., 302 W. 15th St., Austin, Tex.

Stewart, Douglas Gordon (Jun. '48) Instrumentman, C.M. St.P. & P. R.R. Co., Care, Div. Engr. (Res., 1407 Lincoln St.), Miles City, Mont.

Stillman, George Shaw (Jun. '48) Structural Draftsman, James I. Stillman, Structural Engr., 1510 Barbee, Houston, Tex.

Stonestreet, Hardeman Lewis (Jun. '48) (Res., 3704 Lerch St., Chattanooga, Tenn.)

Stratton, William C. (Jun. '48) Partner, Trenton Eng. Co., 234 Broad St. Bank Bldg., Trenton, N.J.

Swanson, Richard Wayne (Jun. '48) Civ. Engr., Wayne County Highway Dept., Wayne Yard (Res., 4409 Monroe Ave.), Wayne, Mich.

Swentek, Raymond Harry (Jun. '48) Civ. Engr., Lamp Construction Co., 164 Division St. (Res., Route 2, Box 10), Elgin, Ill.

Tackett, Cecil Emery (Jun. '48) P-1 Engr., Bureau of Reclamation (Res., Box 346), Trenton, Nebr.

Terenzio, Vincent George (M. '48) Section Engr., New York City Board of Water Supply, Box 96, Valhalla (Res., 45 Park Terrace West, New York), N.Y.

Thompson, David Paine (Jun. '48) Civ. Engr., Standard Oil Co. of California, 225 Bush St. (Res., 3636 Broderick), San Francisco, Calif.

Thompson, Francis Thornton (M. '48) Civ Engr. IV, Tennessee Valley Authority, 514 Powe Bldg. (Res., 3403 Montview Dr.), Chattanooga Tenn.

Tjaden, Maurice Earl (Jun. '48) Resident Engr. Wilson & Co., Engrs., Box 937, Salina (Res., Bo 156, Colby), Kans.

Trott, Cambridge Munro, Jr. (Jun. '48) Charleston Constructors, Inc., East End Tradd St. (Res. 28 Council St.), Charleston, S.C.

Tyndall, Joseph Thomas (Jun. '48) Inspector of Constr., Delaware State Highway Dept. Georgetown (Res., Georgetown), Del.

Varga, Joseph Edwin (Jun. '48) Architectural Eng. Instr., Univ. of Detroit, McNichols Rd. & Livernois (Res., 8546 Prest St.), Detroit, Mich.

Venkataramanan, Thirumanilayur Subramani (Assoc. M. '48) Instr. in Highway Eng., College of Eng. (Res., Staff Quarters, Eng. College), Guindy, Madras, India.

Vogt, Elwood Wayne (Jun. '48) Draftsman Humble Pipe Line Co., P.O. 2180 (Res., 81 Fugate St.), Houston, Tex.

Wagner, Francis H. T. (Jun. '48) Asst. Supervisor of Track, Reading Co., Office Div. Engr. (Res. 6 E. 36th St., Reiffton), Reading, Pa.

Walker, Warren D. (Jun. '48) (Res., 1024 E. 4th St., Tucson, Ariz.)

Wallace, James Alexander, Jr. (Jun. '48) (Res. 1819 W. Jackson St., Phoenix, Ariz.)

Wallace, Robert Henry (Jun. '48) Eng. Draftsman & Design Engr., Strickland & Shroeber Engrs. & Consultants, 718 First National Ban Bldg. (Res., 1528 Monroe Ave., S.W.), Birmingham, Ala.

Ward, Linton E. (Jun. '48) Junior. Eng. Pennsylvania Railroad, Conshocton, Ohio.

Welo, Harlan John (Jun. '48) Inspection Engr. Indiana Insp. Dept., Standard Oil Co., Whiting Ind.

White, Alson Pharoah, Jr. (Jun. '48) Civ. Engr. Bureau of Reclamation Aviola Bldg. (Res. Route 12, Box 488E), Phoenix, Ariz.

White, Sterling Frederick (Jun. '48) Junio Civ. Engr., California State Highway Dept. Dist. VII, Spring & 2d Bldg. (Res., 518 So. Westmoreland), Los Angeles, Calif.

Whitman, Robert V. (Jun. '48) (Res., The Graduate House, Massachusetts Institute of Technology, Cambridge, Mass.)

Willis, William Thomas (Jun. '48) Junior Public Health Engr., State Health Dept., 300 Dexte Ave. (Res., Route 5, Box 257), Montgomery Ala.

Wilson, James David (M. '48) Field Project Mgr. E. I. duPont de Nemours & Co., Care, Eng Dept., 1004 Market St., Wilmington, Del.

Woleben, Wilbur Harry (Jun. '48) Engr., Chicago Bridge & Iron Co., 1500 50th St. W. (Res. 525 So. 55th Pl.), Birmingham, Ala.

Wortham, Miles Frank (Jun. '48) Structural Engr., Rather & Moore & Associates, 1640 Missouri (Res., 3019 Wentworth), Houston, Tex.

Young, Dewey Herman (Jun. '48) Civ. Engr. Bureau of Reclamation (Res., Box 422) Trenton Nebr.

Zarzeka, Frank Peter (Jun. '48) Junior Engr. Rust Eng. Co., Clark Bldg. (Res., 4 Utica Way) Pittsburgh, Pa.

Zerschling, Keith Lee (Jun. '48) Cadastral Engr. U.S. Bureau of Reclamation, 406$^1/_2$ So. Pierre St. (Res., 1218 Cabot), Pierre, S.Dak.

Membership Transfers

Clark, Luther Daniel (Jun. '41; Assoc. M. '48) Engr., United Constr. Co., 401 Burt Bldg. Dallas (Res., 2564 Greene, Ft. Worth), Tex.

Disario, Gabriel Michael (Jun. 28; Assoc. M. '38; M. '48) Consulting Engr., Leon Disario Hernandez, Apartado 1404 (Res., Ave El Bosque 2D, La Florida), Caracas, Venezuela.

Doherty, Charles Francis (Jun. '27; Assoc. M. '37; M. '48) Asst. Section Engr., New York City Board of Water Supply, Neversink (Res. Neversink), N.Y.

Gunder, Dwight F. (Assoc. M. '43; M. '48) Prof. and Head of Mechanics, Acting Prof. and Head of Materials, Cornell University, Ithaca, N.Y.

Hammbs, Kenneth William (Jun. '39; Assoc. M. '48) Hames Eng. Co., P.O. Box 501 (Res., 523 So. Hill St.), Globe, Ariz.

Iakisch, John Rudolph (Assoc. M. '16; M. '48) Chf. Drainage Div., U.S. Bureau of Reclamation (Res., 921 E. 13th Ave.), Denver, Colo.

Kersten, Miles S. (Jun. '34; Assoc. M. '48) Assoc. Prof., Univ. of Minnesota, 114 Exp. Eng. Bldg. (Res., 3716 47th Ave. So.), Minneapolis, Minn.

Krichenberger, Custer F., Jr. (Jun. '43; Assoc. M. '48) Asst. Officer in Charge of Constr., U.S. Navy Contract No. 13360, Box 1310, Fairbanks, Alaska (Res., #2 Runyan Court, Lima, Ohio.)

Leba, Theodore, Jr. (Jun. '35; Assoc. M. '41; M. '48) Structural Engr., Bureau of Plant Industry, Soils and Agricultural Eng., U.S. Dept. of Agriculture, Beltsville Research Center, Beltsville, Md. (Res., 2002 4th St., N.E., Washington, D.C.)

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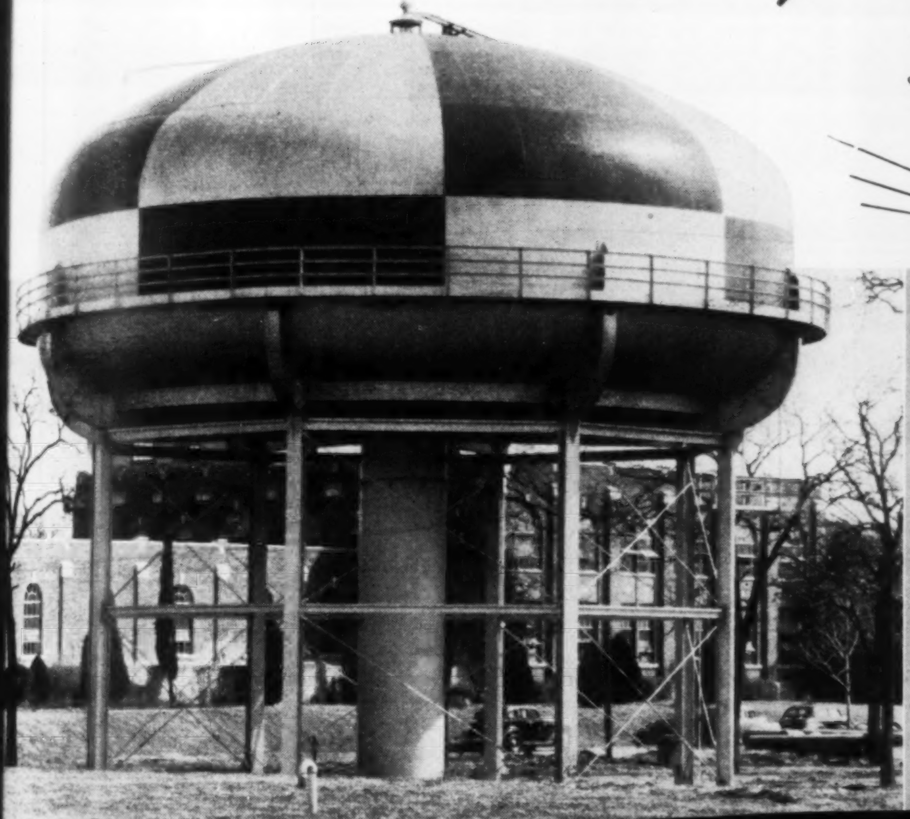

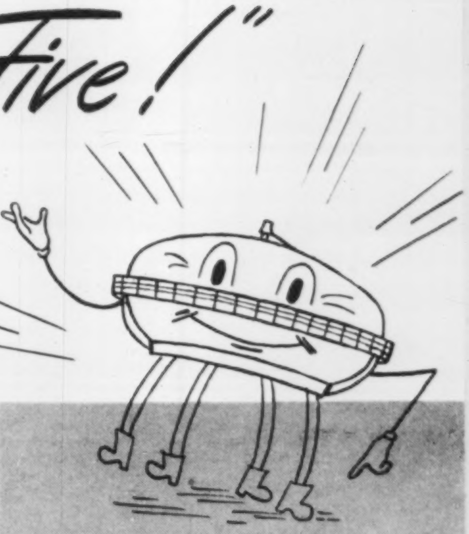

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SEATTLE................978 Lane Street
SANTA CLARA, CAL..........677 Alviso Road

Manganaro, Charles Anthony (Jun. '38; Assoc. M. '48) Structural Engr., Bogert-Childs Eng. Association, 624 Madison Ave. (Res., 136 W. 4th St.), New York, N.Y.

McCarthy, Daniel Vincent (Jun. '41; Assoc. M. '48) Principal Engr., Bureau of Reclamation, Interior Bldg., Rm. 7454, Washington, D.C. (Res., 4417 Dittmar Rd., Arlington, Va.)

Moffatt, John Gray (Jun. '31; Assoc. M. '39; M. '48) Partner, Moffatt & Nichol Inc., Engrs., 800 Kress Bldg., Long Beach (Res., 341 W. California St., Glendale), Calif.

Nottingham, Howard Dailey (Assoc. M. '42; M. '48) Engr., Schmidt & Nottingham, Magnolia Bldg. (Res., 3358 Clyde Dale Dr.), Dallas, Tex.

Randall, Thomas Dudley (Jun. '36; Assoc. M. '48) Secy. and Engr., George W. Randall Co., Inc., Johnstown (Res., 52 Fremont St., Gloversville), N.Y.

Ryan, Philip Lackey (Jun. '45; Assoc. M. '48) Resident Engr., Stone & Webster Eng. Corp., Box M, Elk Basin (Res., Box 41, Powell), Wyo.

Thomas, Albert Cooke (Jun. '33; Assoc. M. '48) Administrative Asst. (Sr.), Safe Harbor Water Power Corp., Lexington Bldg. (Res., 1741 Park Ave.), Baltimore, Md.

Waling, Joseph L. (Jun. '38; Assoc. M. '48) Assoc. Prof. of Eng. Mechanics, Purdue Univ. (Res., 327 Lawn Ave.), West Lafayette, Ind.

Warrington, Francis Carlton (Jun. '37; Assoc. M. '48) Contracting Engr., Pittsburgh Des Moines Steel Co., 1218 Praetorian Bldg. (Res., 4216 Delmar Ave.), Dallas, Tex.

Young, Samuel Richard (Jun. '38; Assoc. M. '48) Asst. Dist. Airport Engr., Civil Aeronautics Administration, 301 Old Post Office Bldg. (Res., 211 Wellington Rd.), Montgomery, Ala.

Reinstatements

Huffman, Russell Benjamin, M., 1275 Westchester Pl., Los Angeles, Calif., reinstated Sept. 24, 1948.

Myers, Boyd Simonton, M., Structural Engr., Robert J. Cummins, Cons. Engr., 1026 Banke Mortgage Bldg., Houston, Tex., reinstated Sep 1, 1948.

Nardone, Gerard Alfonse, Jun., 27-02 On hundred and Sixty-eighth St., Flushing, N.Y. reinstated Sept. 21, 1948.

Padilla, Gustavo Eugenio, Assoc. M., Pres. Institute Engrs. Arc., & Surveyors of Puert Rico, Box 3392, San Juan, Puerto Rico, rein stated Sept. 24, 1948.

Palmgren, Paul Arvid, Jun., 305 E. Fifth St Apt. 43, Jamestown, N.Y., reinstated Sept. 1 1948.

Resignations

Conner, Robert Edward, Jun., 30 S. Lim St., Sierra Madre, Calif., resigned Sept. 3, 1948.

Harris, Ernest Charles, Jun., Asst. Prof., Structural Eng., School of Eng., Fenn College, Eucli at 24th St., Cleveland, Ohio, resigned Sept. 3 1948.

Hoffman, William Joseph, Jun., 1287 Floren Ave., Plainfield, N.J., resigned Sept. 9, 1948.

APPLICATIONS FOR ADMISSION OR TRANSFER

November 1, 1948

Number 11

The Constitution provides that the Board of Direction shall elect or reject all applicants for admission or for transfer. In order to determine justly the eligibility of each candidate, the Board must depend largely upon the membership for information.

Every Member is urged, therefore, to scan carefully the list of candidates published each month in Civil Engineering *and to furnish the Board with data which may aid it in determining the eligibility of any applicant.*

It is especially urged that a definite recommendation as to the proper grading be given in each case, inasmuch as the grading must be based upon the opinions of those who know th applicant personally as well as upon the nature and extent of his professional experience. Any facts derogatory to the personal character o professional reputation of an applicant should be promptly communicated to the Board. Communications relating to applicants are considered strictly confidentia

The Board of Directio will not consider the applications herein contained fro residents of North Americ until the expiration of 3 days, and from non-resident of North America until th expiration of 90 days fro the date of this list.

MINIMUM REQUIREMENTS FOR ADMISSION

Grade	General Requirement	Age	Length of Active Practice	Responsible Charge of Work
Member	Qualified to design as well as to direct important work	35 years	12 years	5 years
Associate Member	Qualified to direct work	27 years	8 years	1 year
Junior	Qualified for subprofessional work	20 years	4 years	
Affiliate	Qualified by scientific acquirements or practical experience to cooperate with engineers	35 years	12 years	5 years

APPLYING FOR MEMBER

Anantram, Taracad Parameswar (Age 50) Eng. Asst., Calcutta Port Commrs., Calcutta, India.

Barnwell, Joseph Brunson (Jun.) (Age 35) Comdr., CEC, U.S. Navy, Public Works Dept. Shipyard, Philadelphia, Pa.

Barry, William Denham (Age 50) Vice-Pres. and Mgr., Austin Bros. Steel Co., Dallas, Tex.

Brill, Clinton Bowen Fisk (Age 55) Director of Technical Services, Ibec Technical Services Corp., New York City.

Carberry, Deane Edwin (Assoc. M.) (Age 38) Comdr., CEC, U.S. Navy, Officer-in-Charge of Constr., Naval Air Missile Test Center, Point Mugu, Calif.

Chambers, Gerald Eugene (Age 43) Asst. Engr., Corps of Div. Engr., New York Central R.R., Cleveland, Ohio.

Curzon, Eugene Charles (Age 49) Valuation Engr. (private practice), Los Angeles, Calif.

Dhanak, Govindlal Girdharlal (Age 39) Delegate of Govt. of Bombay to 3d International Congress on Large Dams and to 2d International Conference of Soil Mechanics, Public Works Dept., Bombay, India.

Drago, Emanuel Anthony (Assoc. M.) (Age 38) Head, Hydrology Sec., Hydr. Engr., P-4, U.S. Engr. Office, Mobile, Ala.

Farnham, William Field (Age 40) Bridge Designer, Modjeski & Masters, Engrs., Harrisburg, Pa.

Flay, George Francis, Jr. (Assoc. M.) (Age 36) Chf. Engr., Drilled-In Caisson Corp., New York City.

Forero, Francisco A. (Age 39) Chf. Engr., Tech. Office, Dept. of Navigation & Ports, Ministry of Public Works, Bogota, Colombia.

Fox, James May (Jun.) (Age 35) Civ. and Structural Engr. (private practice), South Gate, Calif.

Fragoso, Paulo Rodrigues (Age 44) Cons. Structural Engr., Rio de Janeiro, Brazil, Avenida Erasmo Braga 277–130. (Temporary address, New York City.)

Goldston, William Major (Age 54) Owner, Middleton & Goldston Constr. Co., Corpus Christi, Tex.

Grossman, Isidore Sam (Age 44) Civ. Engr., Board of Water Supply, New York City.

Hamilton, Charles Thomas (Age 64) Cons. Civ. and Structural Engr. (private practice), Vancouver, B.C., Canada.

Hartman, Herman Daniel (Age 60) Member, State Highway Comm. of Indiana, Indianapolis, Ind.

Heil, Joseph Norman (Assoc. M.) (Age 50) Highway Engr., PRA, Div. Office, St. Paul, Minn.

Hendrick, Jasper Reginald (Assoc. M.) (Age 35) Design and Constr. Engr., Water Dept., Ft. Worth, Tex.

Ingram, Temple Byrn (Assoc. M.) (Age 42) Senior Res. Engr. with Texas Highway Dept., Gilmer, Tex.

Keith, John Wilbur (Age 38) Prof. Civ. and Mech. Engr., Galveston, Tex.

Kennedy, David Ramsay (Age 71) Head, Pipeline Sewage Disposal Div., and Supt. of Sewer Maintenance, Long Beach, Calif.

Kersting, Edward Henry (Assoc. M.) (Age 36) Gen. Supt., Frazier-Davis & MacDonald, Balboa, Canal Zone.

Kosh, David Alperin (Assoc. M.) (Age 36) Chf., Public Utilities Div., Bureau of Federal Supply, U.S. Treasury Dept., Washington, D.C.

Lefkowitz, Arnold Lewis (Age 44) Chf. Engr., North American Iron & Steel Co., Brooklyn, N.Y.

Li, Wen-Pang (Assoc. M.) (Age 42) Deputy Director, Pearl River Conservancy Bureau, Canton, China.

Maley, William Teahen, Jr. (Jun.) (Age 35) Public Works Officer, NOB, Argentina, Public Works Office, Navy 103, Care, Fleet Post Office, New York City.

O'Marra, Wayne Gilder (Assoc. M.) (Age 45) Chf. Chemist, Arizona Highway Dept., Phoenix, Ariz.

Rao, Mannige Anand (Age 39) Chf. Engr., Jodhpur Ry., Technical and Administrative Head of Civ. Eng. Dept. of entire system, Jodhpur, India.

Richardson, Worth Bluford (Age 45) Constr. Supt., TVA, Chattanooga, Tenn.

Rippstein, Edwin Eugene (Assoc. M.) (Age 46) In charge of Eng. Dept., Laclade Steel Co., St. Louis, Mo.; University City, Mo.

Savage, William Joe (Age 40) Asst. Chf. Engr., Texas & Pacific Ry., Dallas, Tex.

Seib, Charles Bach (Assoc. M.) (Age 62) Hydr. Engr., Pennsylvania Power & Light Co., Allentown, Pa.

Sharp, Wilbur Louis (Assoc. M.) (Age 58) Rate Engr., Portland Gen. Elec. Co., Portland, Ore.

Stevenson, George Franklin (Assoc. M.) (Age 43) Senior Project Engr., Louisiana Dept. of Highways, New Orleans, La.

Syversen, Harold (Age 37) Partner, Sy-Co Engrs., Vice-Pres., Sy-Co Corp., West Englewood, N.J.

Tapley, George Manning (Assoc. M.) (Age 46)

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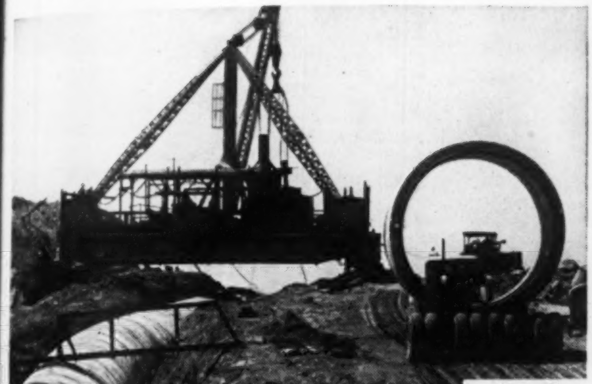

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Altimeters

Chf., Eng. Div., Alaska Road Comm., Juneau, Alaska.

TONINI, DINO (Age 43) Assoc. Prof. of Hydrology, Univ. of Padua, Italy, Care, Soc. Adriatica di Elettricita, Venice, Italy.

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WEBER, EUGENE WILLIAM (Assoc. M.) (Age 37) Special Asst. to Asst. Chf. of Engrs. for Civil Works, Office of Chf. of Engrs., Washington, D.C.

WEGENSTEIN, MAX EMIL (Age 52) Cons. Engr. (private practice), Zurich, Switzerland.

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WOODALL, MAX THEODORE (Assoc. M.) (Age 38) Structural Engr., United Engrs. & Constrs., Inc., Philadelphia, Pa.

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BARGAS, JOHN RAYMOND, SR. (Age 39) Civ. Engr., Corps of Engrs., U.S. Army, New Orleans, La.

BENT, PAUL CAP (Jun.) (Age 34) Asst. Engr. and Hydr. Engr., U.S. Geological Survey, Tacoma, Wash.

BISHOP, JOHN AUGUSTINE (Age 34) Instructor of Civ. Eng., and graduate student. Univ. of Florida, Gainesville, Fla.

BROOKS, MARVIN VANCIL (Jun.) (Age 34) Constr. Engr. and Partner, S. Clyde Carpenter & Co., Denton, Tex.

CHAMBERLIN, HARVEY ENOS (Age 39) First Asst. with O. R. McElya, Engrs., Dallas, Tex.

COTTER, RALPH EVANS, JR. (Jun.) (Age 35) Owner, Ralph Cotter & Associates, Civ. Engrs., Oak land, Calif.

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DELINKS, JOSEPH ADAM (Age 42) Structural Engr., U.S. Atomic Energy Comm., Dept. of Public Works, Oak Ridge, Tenn.

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GHOSE, SUNIL KUMAR (Age 29) Graduate student, Columbia Univ., New York City.

GRAHAM, JOHN WILLIAM, JR. (Jun.) (Age 33) Asst. Prof. of Civ. Eng., Carnegie Inst. of Technology, Pittsburgh, Pa.

HANSEN, ROBERT JOSEPH (Jun.) (Age 30) Asst. Prof. of Structural Eng., Massachusetts Inst. of Technology, Cambridge, Mass.

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HOGE, GEORGE JAMES (Age 35) Head, Design Unit, Upper Missouri Dist., U.S. Bureau of Reclamation, Great Falls, Mont.

JOHNSTON, ROY GUNNAR (Jun.) (Age 34) Member of firm, Brandow & Johnston, Cons. Structural Registered Engrs., Los Angeles, Calif.

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KALIL, JOHN HANNA (Age 32) Structural Eng. Associate, Dept. of Water & Power, Los Angeles, Calif.

KIEL, PAUL MARTIN (Jun.) (Age 34) Staff Engr., Floyd G. Browne & Associates, Marion, Ohio.

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LAMPP, EDWARD RICHARD (Age 33) Asst. Engr., and Co-owner, Marion Eng. Associates, Inc., Ocala Fla.

LANOIX, JOSEPH NECKER (Jun.) (Age 29) Dir. Gen., Republic's Water Dept., Ministry of Public Works, American Sanitary Mission, Palais des Ministeres, Port-au-Prince, Haiti.

LAUGHTER, CLYDE NEELY (Jun.) (Age 35) Graduate Teaching Asst., Civ. Eng. Dept., Northwestern Univ., Evanston, Ill.

MACKELLAR, DONALD CAMPBELL (Age 38) Senior Engr., Water-Works Branch, City Engr., Cape Town, South Africa.

MARDEN, DANIEL SEAVEY (Jun.) (Age 34) Bldg. Engr., Hanford Engr. Works Expansion, Richland, Wash.

MATERNIK, FRANCIS CHARLES (Age 29) Structural Steel Designer, E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

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MENDENHALL, IRVAN FRANK (Jun.) (Age 30) Civ. Engr. (private practice), Los Angeles, Calif.

METCALF, LAURENCE REGNELL (Jun.) (Age 34) Head, Outlet Structures Group, Hydr. Design Sec., Dist. Office, Corps of Engrs., Portland, Ore.

MOORE, NORMAN HARNED (Jun.) (Age 34) Instructor, Johns Hopkins, Univ., Baltimore, Md.

MORGAN, JOHN ROLLIN (Jun.) (Age 33) Asst. Engr. to Senior Engr., U.S. Bureau of Reclamation, Sacramento, Calif.

MURPHY, THOMAS EDWARD (Jun.) (Age 34) Hydr. Engr., P-5, Chf., Structures Sec., Waterways Experiment Station, Vicksburg, Miss.

PASCHEN, CLAYTON FREDERIC (Age 41) Asst. Chf. Engr., Cook County Highway Dept., Chicago, Ill.

PATTON, JOHN JEFFERSON (Age 45) Conservation Engr., Alabama Dept. of Conservation, Prattville, Ala.

PIERCE, WALTER HOWARD (Jun.) (Age 35) Asst. Prof. of Civ. Eng., Univ. of Alaska, College, Alaska.

PENMAN, ROBERT ROY (Jun.) (Age 34) Asst. Head Engr., Standard Oil Co., Whiting, Ind.; Highland, Ind.

PERRY, THOMAS HENRY, JR. (Jun.) (Age 34) Civ. Engr., P-3, U.S. Engr. Office, Nashville, Tenn.

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RECK, CHARLES WILLIAM (Jun.) (Age 34) Hydr. Engr., P-3, U.S. Geological Survey, Ellenville, N.Y.

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(Continued on page 97)

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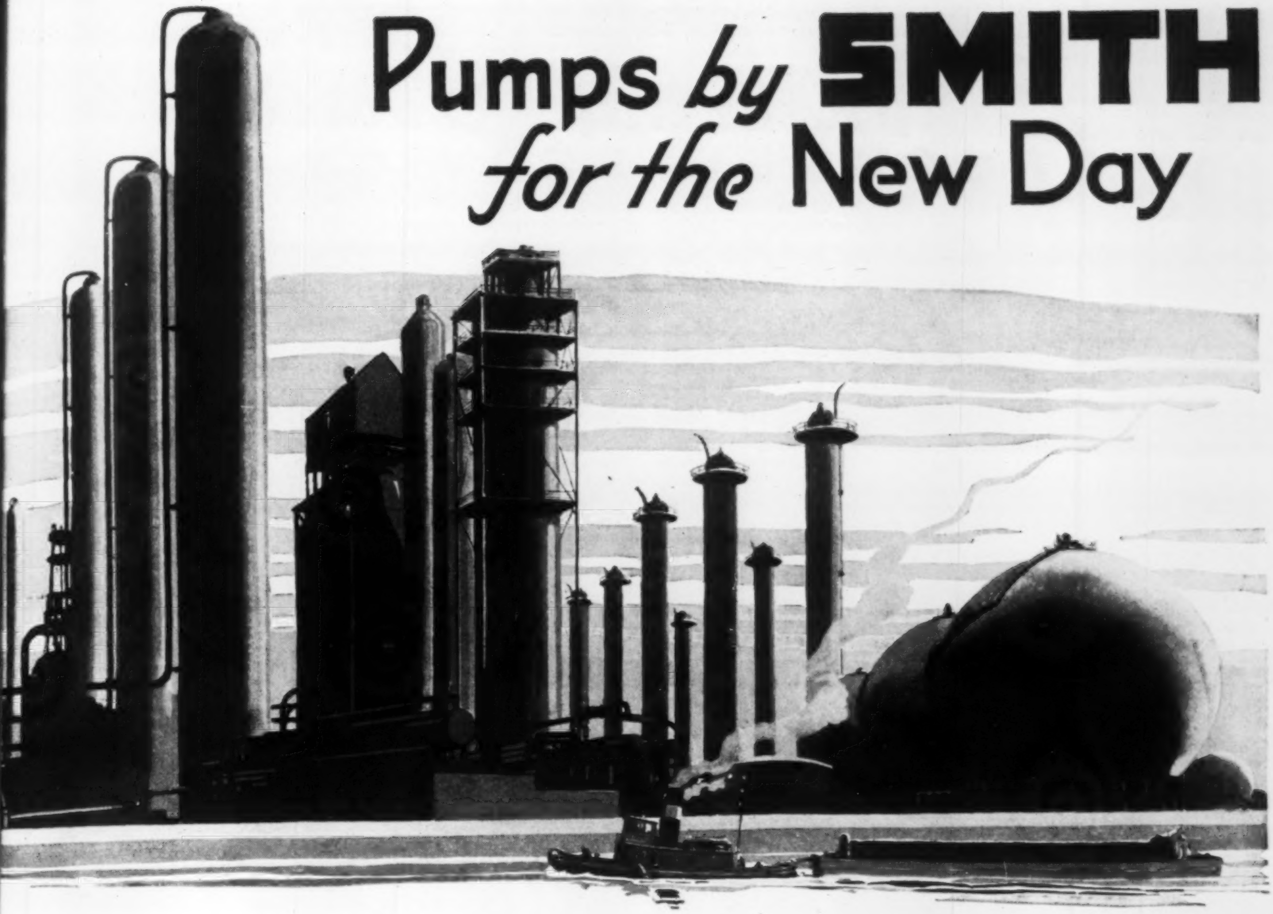

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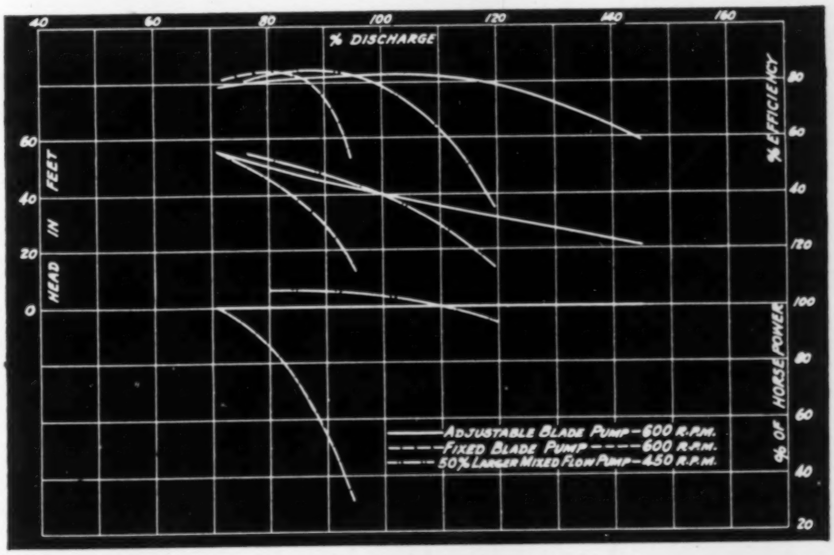

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(*Continued on page 97*)

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(Continued from page 96)

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(Continued from page 94)

Reyholec, Otto Frank (Jun.) (Age 34) Engr. (Hydr.) Dept. of Army, Corps of Engrs., New York City.

Reynolds, Kenneth Burr (Jun.) (Age 35) Design Engr., Eng. Office of Clyde C. Kennedy, San Francisco, Calif.

Ripken, John Frederick (Jun.) (Age 34) Associate Prof. of Hydraulics, Univ. of Minnesota, St. Anthony Falls Hydr. Laboratory, Hennepin Island, Minneapolis, Minn.

Shelton, Willie Clyde (Jun.) (Age 34) Owner, The W. C. Shelton Co., Constrs., Lawton, Okla.

Snyder, Perry Courtney (Age 36) Engr., Gannett, Fleming, Corddry & Carpenter, Inc., Wilkinsburg, Pa.

Soderberg, Richard Gottfried (Jun.) (Age 35) Civ. Engr., Gen. Eng. Corp., Minneapolis, Minn.

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Stevenson, Herman Fulmer (Age 30) Structural Engr., Faisant & Kooken, Cons. Engrs., Baltimore, Md.

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Wenzel, Harold Bernard (Jun.) (Age 31) Asst. Prof., Oklahoma Agricultural and Mechanical College, Stillwater, Okla.

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Whitney, James Schuyler (Age 27) Res. Engr., American Airlines Hangar, O. H. Amman, Cons. Engr., New York City.

Will, Albert Parks (Jun.) (Age 35) Supervisor, Gen. Eng. Dept., Phillips Petroleum Co., Bartlesville, Okla.

Yeatts, Ernest Bailey (Age 43) Owner, E. B. Yeatts, Contr., Abilene, Tex.

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Ashton, Walter Lewis, Jr. (Age 26) Asst. Engr., Terminal R.R. Association of St. Louis, St. Louis, Mo.

Callas, Michael George (Age 27) Engr., The Whiting-Turner Contr. Co., Baltimore, Md.

Cellucci, Philip James (Age 26) With Frank Cellucci, Gen. Contr., Philadelphia, Pa.

Cox, John West (Age 23) Instructor and Graduate Student, Purdue Univ., West Lafayette, Ind.

Hugie, Ray Charles (Age 26) City Engr., 643 East Fourth Lorth, Logan, Utah.

Lausell, Demetrio (Age 26) Civ. Engr. II, Dept. of Interior, Puerto Rico; at present graduate student Ohio State Univ., Columbus, Ohio.

Logan, William Gordon (Age 29) Jun. Design Structural Engr., Eng. and Constr. Dept., Duquesne Light Co., Pittsburgh, Pa.

McFarland, Fred Sleyden (Age 26) Field Engr., Constr. Dept., Alabama Power Co., Birmingham, Ala.

Nelson, Robert Lyman (Age 27) Design Engr., J. E. Greiner Co., Baltimore, Md.

Rice, James Martin (Age 30) Graduate student and Graduate Research Asst., Purdue Univ., East Cleveland, Ohio.

UNIV. OF AKRON	Age
Ruhlin, William Ritter, 1948	(22)
UNIV. OF ALA.	
Burnam, Hubbard Denson, Jr., 1948	(24)
Evans, William Knight, 1948	(27)
Jones, Robert Lee, Jr., 1948	(22)
Polk, Malcolm Downing, 1948	(22)
UNIV. OF ARK.	
Patridge, Jesse James, Jr., 1948	(22)
BROOKLYN POL. INST.	
Hartog, Donald Gregory, 1948	(26)
BUCKNELL UNIV.	
Baut, Harry Stanley, 1948	(26)
Gerla, Stanley Robert, 1948	(23)
UNIV. OF CALIF.	
Eubanks, Marks Sherman, 1948	(25)
Hantush, Mahdi Salih, 1947	(27)
Saunders, Roderick William Brandreth, 1948	(33)
Sivalingam, Pandaranadar, 1948	(26)
CARNEGIE INST. TECH.	
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Fowler, John William, 1948	(21)
Gwinn, Wendell Rudolph, 1948	(22)
COLO. A. & M. COLL.	
Brown, Frank McGhinnis, 1948	(23)
More, David Cobbey, 1948	(26)
UNIV. OF COLO.	
Bird, Barbara Hedden, 1948	(22)
Ebner, Keith John, 1948	(23)
Farabee, Thomas Caleb, 1948	(25)
Frehse, William Robert, 1948	(25)
Frischer, Donald, 1948	(21)
Maydew, Bernard Eugene, 1948	(26)
Moore, Oral Lester, 1948	(27)
Mott, George Edward, 1948	(24)
Parker, Delbert, 1948	(29)
Robinson, Leonard Lee, 1948	(29)
Simmonds, Richard Joe, 1948	(24)
Sparks, Warren Orville, 1948	(24)
Wensley, Alfred Wadsworth, 1948	(22)
CORNELL UNIV.	
Smith, Maurice Dudley, Jr., 1948	(23)
Van Epps, Robert James, 1947	(26)
DRESEL INST. TECH.	
Kowalski, Andrew, 1948	(24)
Moyer, Walter Silverwood, 1948	(26)
UNIV. OF FLA.	
Campbell, Austin Fain, 1948	(26)
GA. SCHOOL TECH.	
Clement, Coleman Clay, Jr., 1948	(26)
UNIV. OF ILL.	
Baugher, George William, 1948	(27)
Eads, Robert Earl, 1948	(24)
Heil, Richard Wendell, 1948	(22)
Jansen, Charles Levin, Jr., 1948	(25)
Kalivopoulos, Alexander Demetre, 1948	(28)
Lewis, John Oliver, 1948	(25)
Maxwell, Raymond Pius, 1948	(26)
Peters, Carl Dean, 1948	(24)
Schmidt, Barbara Lou, 1948	(21)
Schroeder, Herbert Adam, 1948	(26)
Smith, William Harry, 1948	(25)
Zirzow, Charles Fred, 1948	(25)
IOWA STATE COLL.	
Hungett, Roscoe, Jr., 1948	(25)
Scheer, Alfred Carl, 1948	(22)
JOHNS HOPKINS UNIV.	
Klingenmeier, Russell John, Jr., 1948	(26)
KANS. STATE COLL.	
Hart, William Carl, 1948	(24)
Smith, Bobby Lee, 1948	(22)
UNIV. OF KY.	
Galloway, Thomas Roddy, 1948	(22)
Stevens, William J., 1948	(26)
Teeter, Robert Lawrence, 1948	(22)
UNIV. OF MAINE	
Whitney, Philip Cushing, 1948	(24)
MANHATTAN COLL.	
D'Amico, Anthony Eugene, 1948	(20)
MASS. INST. TECH.	
Gross, Clifford Milton, 1948	(31)
Widelitz, Milton Alvin, 1948	(24)
Wood, Robert Hall, 1948	(27)
MICH. STATE COLL.	
Hashmi, Tajammal Hussain, 1948	(25)
Luhrs, Millen Ernest, 1948	(24)
MO. SCHOOL OF MIN. & MET.	
Watkins, Paul Allen, 1948.	(24)
UNIV. OF. MO.	
Bock, Arnold Henry, 1948	(24)
Brown, James Hamilton, 1948	(21)
Edwards, Clement Melvin, 1948	(23)
Graham, Harry James, 1948	(23)
Lefler, Lyle Gene, 1948	(23)
Marcinkowski, Henry Stanley, 1948	(24)
Stark, Monroe Elliott, 1948	(22)
Vincent, Paul Kenneth, 1948	(28)
UNIV. OF. NEBR.	
Cole, Hayward Charles, Jr., 1948	(28)

	Age
N. MEX. A. & M. COLL.	
Dominguez, George Donaciano, 1948	(27)
N. DAK. STATE AGRI. COLL.	
Rash, Francis Alvin, 1948	(29)
UNIV. OF NOTRE DAME	
Duarte, Jose Napoleon, 1948	(24)
OHIO STATE UNIV.	
Lucas, Robert Bruce, 1948	(24)
Weisent, Ray Francis, 1948	(25)
OKLA. A. & M. COLL.	
Davidson, John Breckenbridge, 1948	(27)
UNIV. OF OKLA.	
Bickel, George, 1948	(27)
ORE. STATE COLL.	
Stockton, William Nolan, 1948	(33)
PA. STATE COLL.	
Faber, Fred Samuel, Jr., 1948	(24)
Limperis, Thomas, 1948	(22)
UNIV. OF PITTSBURGH	
Kamin, Marvin, 1948	(21)
Noll, Raymond Franklin, 1948	(21)
Richards, Eugene Stazola, 1948	(30)
PURDUE UNIV.	
Glasgow, Charles Walter, 1948	(22)
Heierman, Albert Emil, Jr., 1948	(23)
Koch, William Earl, 1948	(22)
Murphy, Charles Daniel, 1948	(23)
Monical, Robert Duane, 1948	(23)
UNIV. OF SO. CALIF.	
Cummings, Jerome Vincent, 1948	(25)
Dishion, William Joseph, Jr., 1948	(26)
Meyer, Robert Herman, 1948	(28)
Schneider, Samuel, 1948	(23)
STANFORD UNIV.	
Fox, Tom, Jr., 1948	(27)
UNIV. OF TENN.	
Cole, William George, 1948	(28)
Fowler, John Williams, 1948	(25)
TEX. A. & M. COLL.	
Belvin, Morton Thomas, Jr., 1948	(24)
Grafa, Otis Witham, Jr., 1948	(26)
Greif, Wilbur William, 1948	(29)
Hix, Charles Madison, Jr., 1948	(22)
Ogan, William Hemsley, 1948	(28)
Puckett, James Almon, 1948	(26)
Thoma, Charles William, 1948	(21)
Wright, Robert Earl, 1948	(20)
TEX. TECH. COLL.	
Simmons, Roy Clyde, 1948	(28)
UNIV. OF TEX.	
Bennett, Gary Stelson, 1947	(29)
UNIV. OF UTAH	
Carter, Alan Charles, 1948	(25)
VANDERBILT UNIV.	
Mosby, Robert William Franklin, 1948	(24)
West, Johnson Manier, Jr., 1948	(24)
VA. POL. INST.	
Frazier, William Nelson, 1948	(29)
WASH. STATE COLL.	
Vitale, Morris Anthony, 1948	(24)
WASHINGTON UNIV.	
Heuckroth, William Ernest, Jr., 1948	(21)
Jantzen, Louis Poirot, 1948	(27)
Kling, Robert Everett, 1948	(23)
W. VA. UNIV.	
Arters, Emlyn David, 1948	(29)
UNIV. OF WIS.	
Folts, William Edward, 1948	(22)
Korbitz, William Emil, 1948	(21)
WORCESTER POL. INST.	
Tracy, Richard Lawrence, 1948	(23)

The Board of Direction will consider the applications in this list not less than thirty days after the date of issue.

NOW... for every EXTERNAL VIBRATION problem...

the new VIBER MODEL PX-6
PNEUMATIC EXTERNAL VIBRATOR

The Viber Model PX-6, primarily designed for concrete pipe manufacture, has since proven equally effective in other fields such as in the manufacture of concrete products, and in the handling of dry materials.

5 Reasons for Outstanding Versatility in the PX-6

1. Operates at desired amplitude over a wide range.
2. Operates at desired speed over a wide range.
3. Produces marked improvement in the manufacture of concrete pipe from the smallest to the largest.
4. With proper balance of amplitude and speed, greatly increases the life of the forms.
5. May be mounted at any angle.

SPECIFICATIONS

SIZE: Diameter 5½ inches; length 12 inches.
NET WEIGHT: 40 pounds.
ECCENTRIC WEIGHT: Available over a wide range of sizes.
VIBRATING SPEED: Desired speeds are obtained by regulation of the air pressure.
POWER: Dependable vane type pneumatic motor.
COOLING: Cooled by circulation of exhaust air through the housings.

Mounting Clamp, Carrying Handle
Available as extra equipment.

For complete details of the VIBER Model PX-6 Pneumatic *External* Vibrator—or assistance on any concrete placement problem involving *internal* vibration—*write or wire:*

VIBER CO EST. 1931
CONCRETE VIBRATORS
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EQUIPMENT, MATERIALS *and Methods*

NEW DEVELOPMENTS OF INTEREST, AS REPORTED BY MANUFACTURERS

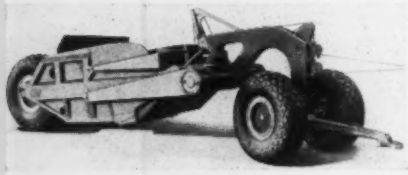
Lift Truck Models

A MANUFACTURER OF fork lift trucks, tractors and accessories, is offering assistance, in the form of an accurately designed, quarter-inch scale model fork lift truck, to plant engineers and other executives interested in formulating efficient factory layout plans. The realistic miniature Towmotor fork lift trucks are easily moved about, rolling freely on tiny scale size wheels and can even carry scale model loads on the forks. The increased use of scale model buildings, machinery and other production equipment for plant and office layout work has been due to the savings in time and costs made possible by the three-dimensional models. Visual planning with scale models aids in locating water, steam and power lines, provides an accurate estimate of floor requirements and loads and, in the case of the new miniature Towmotors, assists in planning the most effective and economical materials handling routes. The scale model Towmotor fork lift truck is available, to plant management men, at a cost of $1.50 each. Requests for models should be addressed to **Towmotor Corp., 1226 E. 152nd St., Cleveland 10, Ohio.**

◆

New Earthmoving Equipment

THE CATERPILLAR TRACTOR COMPANY announces ten new additions to their line to be in production within the near future. The new products will include expansions to existing lines as well as entry into the 500 hp diesel engine field. Also featured are a new two-wheeled diesel tractor-scraper unit; a new four-wheeled diesel tractor-wagon unit; two additional scrapers; four new diesel engines as industrial power units and a fifth new diesel engine integral with the wheel-type tractors. The new products point up the postwar trend towards a complete earthmoving package. The construction field will have application for the earthmoving equipment in all phases of activity; road building and maintenance, airport construction, dam building flood control, land leveling, railroad off-track maintenance, housing and building site preparation and development, municipal road and street network construction and all general earthmoving. The engines provide the power answers for crushing plants, ditchers, locomotives, portable power plants and like installations. **Caterpillar Tractor Co., Peoria 8, Ill.**



Trench Roller

BUILT FOR ROAD WIDENING, relocation, repair, and various types of new construction work, the trench roller was designed with features of particular interest to the operator. To give the operator the advantage of facing his work at all times, the seat pivots around the steering post. A hydraulic jack permits raising or lowering the outboard wheel to level the machine when working in any trench up to 13 in. The locking pin, controlled from the operator's seat, holds the adjusting wheel at the desired height. The roller is powered by an efficient four-cylinder, air-cooled engine. The transmission provides two speeds for both forward and reverse motion. The Huber trench roller is equipped with a brake for service and parking, a 50-gal-capacity sprinkling tank with mats on both rolls that run in the trench, and spring-tensioned scrapers on the rolls and adjusting wheel. A short wheelbase of 90 in. and a short turning radius achieved by design engineers are other features of the trench roller. **The Huber Mfg. Co., Marion, Ohio.**

◆

Valve Capacity Calculator

A VALVE CAPACITY calculator, offered without charge and applicable to the new K&M line of Kontrol-Motor diaphragm valves and pressure regulators, is now available. The calculator has been developed from the results of extensive laboratory tests and is based on three factors: rate of flow through the valve, or capacity; static pressure and drop through the valve, or resistance; valve size. Correction scales for steam quality and liquid and gas specific gravity are included as well as a flowing temperature scale for gases. Of circular slide-rule type, the calculator is 8 in. in diameter, has long, open scales that are easily read. **Kieley & Mueller, Inc., North Bergen, N.J.**

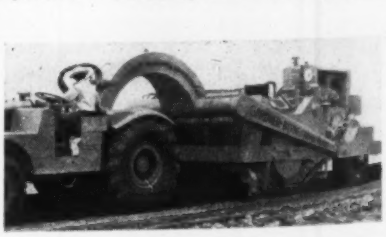
Drafting Machines

A NEW, STAINLESS STEEL drafting machine saves up to 50 percent expensive drafting labor time and cost and will operate with perfect accuracy on any size or make drawing board without the addition of extra equipment or alteration of the drawing board. Through the machine's convenience of operation in any position from true horizontal to true vertical, a comfortable working position is continuously maintained. Indexing of angles is simple, fast, and easy through the use of the micromatic quadrant, which allows indexing of every 3 deg by simply "flipping" the quadrant minute adjusting screw into desired degree setting and adjustments as fine as $2^{1}/_{2}$ min by a slight turn of the minute adjusting screw. Emmert drafting machines are manufactured for boards 24, 30, 36, 42, 48, 54, 60, 72, 84, 96, 108, 120, and 132 in. by any length and special machines, including left-handed machines, can be furnished for odd size drawing boards. **Emmert Mfg. Co., Waynesboro, Pa.**

◆

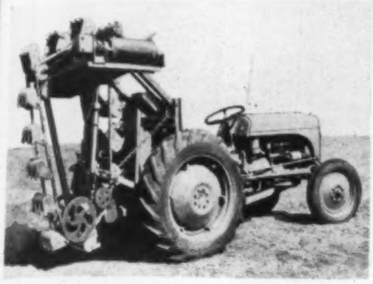
Travel-Mix Plant

A ONE-PASS TRAVELING MIXER with a capacity of 600 to 750 tons per hour has been developed for emulsion or cement stabilization, and for bituminous road mix paving; for soil blending its capacity is 1,000 cu yd per hour. Self-powered by a 135-hp diesel motor and with complete hydraulic one-man control, it can be fitted to the purchaser's tow-tractor or is offered in combination with a tractor. Water or liquid bitumen and forward travel are accurately metered, both being clearly shown on a single large dial in full view of the operator. This, together with adjustable control of the aggregate flow, assures positive proportioning. A spool on which is mounted six opposing rows of large harrow-type disks rotates at relatively high speed, gathering the material from the windrow and carrying it through the mixing cycle, the action being not only circular but beating back and forth as well. From the mixing spool the material is thrown onto a high-speed "spinner," which rewindrows it behind the mixer. **Gardner-Byrne Construction Co., Inc., Los Angeles, Calif.**



Trenching Machine

It is claimed that this new trenching machine will equal the pick and shovel work of 25 men and that it is expressly suited for digging housing project foundations; irrigation lines; water, gas, electric and sewer lines, for farm irrigation and kindred work. This new trencher cuts clean trenches in soils of all types, with its cast steel digging buckets. It has adjustable clearance teeth and digs from 12 to 18 in. in width. It is possible to dig an additional width trench by extending the wheel width of the Ferguson Tractor. This new trencher can be set to cut any distance down to 42 in. deep, and it travels from 1½ to 5 ft a min depending upon the depth and width of cut and type of soil. The trencher is credited with having many features such as: special transmission for necessary speed reduction. This can be switched to standard tractor speeds by a handy shifting lever. It can travel over curbs and up inclines and maneuvers quickly into working position. It can be moved from job to job under the tractor's own power or be transported easily by trailer. The trencher is safe to operate, it eliminates expensive hand labor and it is claimed that it does the work of trenching machines costing much more and thus operates on a low-cost, profitable basis. **The Tractor Sales Corp., 1409 Sante Fe Ave., Los Angeles 21, Calif.**



◆

Traffic Paints

A new traffic paint based on two Hercules Powder Company chemicals, Pentalyn 802A, a synthetic resin, and Parlon, chlorinated rubber, has proved to be outstanding in both durability and rapid dry. Test cross lines laid down on a highway intersection in South Camden, N.J., considered to be the second busiest highway intersection in the state, show little signs of wear after more than two months of service. Cross lines of a specified formulation in current use by the state, were laid down at the same time alongside the Pentalyn 802A-Parlon paint and were almost worn away at the end of the two months. The test lines were applied to both concrete and asphalt surfaces. The prime requisites of traffic paints are rapid speed of dry and durability. This is particularly true of intersection cross lines where the paint is subjected to the most traffic wear. Drying speeds of these paints vary from 11 min to 12 min depend-

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THEY'RE KOPPERS PRESSURE-CREOSOTED FOUNDATION PILES

That's the beauty of installing Koppers Pressure-Creosoted Piles—*they are in to stay.* The permeation of creosote protects these piles against decay, termites and acid or alkaline soils. And the wood retains the creosote year after year. Here's proof: some pressure-creosoted piles were pulled after being in use for nearly fifty years; they were still "loaded with creosote."

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a complete engineering reference on the scientific data and methods basic to all problems of water control

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During the last 15 or 20 years several million dollars have been spent on hydrologic investigations and the accumulation of hydrologic data. This is the first book to make use of this important material in a systematic study of precipitation and runoff.

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Especially useful are the many examples showing how methods of statistical analysis may be advantageously applied to hydrologic data for greater dependability and accuracy of prediction.

Convinced that all engineers working today on water control projects will find this an invaluable book to have in their professional reference libraries, we urge you to

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Please send me a copy of RAINFALL AND RUNOFF @ $9.00 with the understanding that if I return it in 10 days my bill will be cancelled.

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Address ....

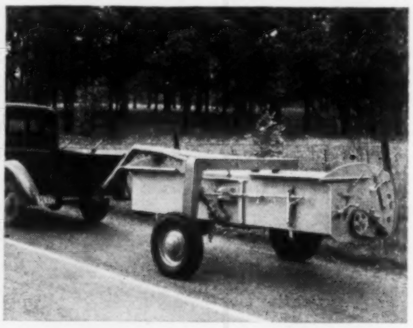
.... C

ing on such factors as thickness of film and type of solvent. The fast drying time reduces the amount of time traffic has to be rerouted. The outstanding durability means fewer applications per year with consequent savings in man-hours and paint gallonage. When applied with conventional type traffic-marking equipment on asphalt surfaces, these paints do not cause bleeding. **Hercules Powder Co., Inc., Wilmington, Del.**

◆

Transporter for Spreader Boxes

EASY, SAFE AND FAST loading and transportation of heavy stone or chip spreader boxes is provided by this safe-easy transporter on which 9 to 12-ft boxes can be trailed at full speed behind any light pick-up truck. The serious traffic hazard created by transporting boxes crosswise of the road is eliminated as well as the dangerous work of loading heavy spreaders on trucks, which is usually a 6 to 8-man job. Only one man is needed to place the transporter over a spreader box. Then, using the worm gear crank on the machine, he easily hoists the box on two lifting hooks and further secures it with a chain sling, tightened by turnbuckle. The front end of the box bolts to the rigid drawbar for traveling. Loading is accomplished in less than $1^1/_2$ min. Unloading is equally simple. The unit is only 69 in. wide, hub to hub. No extra rider is needed when transporting spreaders on streets or heavily traveled highways. **The Highway Special Equipment Co., 2040 Wilson Rd., Hilliards, Ohio.**



◆

Hydradozer

CARCO STRAIGHT and angle blade Hydradozers built to fit the largest crawler tractors and to insure speedy action and smooth operation feature a front mounted, closed type, hydraulic system with pump, control valve, and reservoir in one unit. A new push-pull cable control eliminates control rods and linkage and makes a handier control from the operators standpoint. New moldboard adjustments give quick change to cut or tilt on both angle and straight blade models. Change is made by resetting a single pin in back of each corner of the moldboard. Maximum

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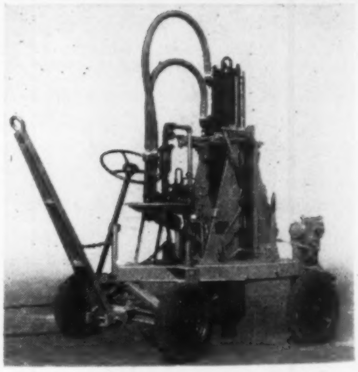
BREAK PAVEMENT
the low cost way!



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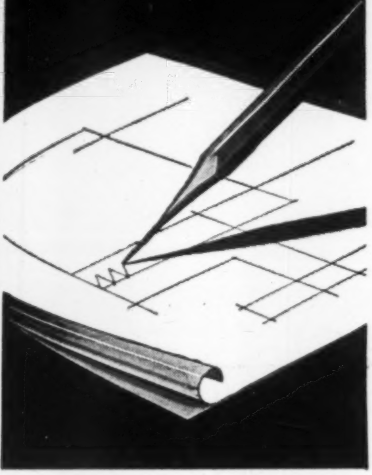
TRACING CLOTH
for
HARD PENCILS



● Imperial Pencil Tracing Cloth has the same superbly uniform cloth foundation and transparency as the world famous Imperial Tracing Cloth. But it is distinguished by its special dull drawing surface, on which hard pencils can be used, giving clean, sharp, opaque, non-smudging lines.

Erasures are made easily, without damage. It gives sharp, contrasting prints of the finest lines. It resists the effects of time and wear, and does not become brittle or opaque.

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PENCIL
TRACING
CLOTH

SOLD BY LEADING STATIONERY AND DRAWING MATERIAL DEALERS EVERYWHERE.

tilt is 18 in. from horizontal. The moldboard has a three-piece cutting edge whose centerpiece of tough alloy steel is reversible and whose end bits are of heavy manganese steel. The two-way side frame trunnion has large bearing surfaces, takes up side frame twist and holds moldboard tilt solidly with a minimum of wear on the trunnion. Side frames are box frame construction and are attached to the moldboard by two frame pins and a tilt adjusting stub, sleeve and pin at each side. Double-acting, hone-finished steel cylinders equipped with chevron-type packing are mounted on a universal trunnion bracket. This type mounting permits free movement and self-alignment of cylinders without bending or scoring the piston rods. Piston rods are of high-grade alloy steel and are chrome plated for greater wear and rust resistance. **Pacific Car and Foundry Co., Renton, Wash.**

◆

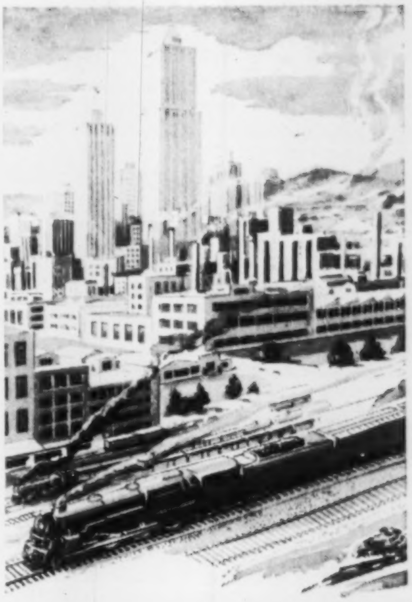
Scaffolds

Eliminating the old type extension ladders and complicated scaffolding in construction and maintenance work, new, revolutionary scaffolds are specially designed to simplify operations and drastically reduce labor costs. Made of light weight aluminum alloy, a 7-ft, single section unit requires one man just a minute to erect; a 45-ft multiple unit only 15 min. Up-Right scaffolds are mobile; and the instantly adjustable legs provide stability and desired working level. Scaffolds are available in any number of section units. The amazingly simple lock-in feature eliminates all wing nuts, bolts, loose parts; and requires no wrenches. Each section folds flat. $4^1/_2 \times 6$ ft of foundation area is standard with optional outboard supports available to provide a 10×10 ft foundation area. A safety-tread stairway permits the user to mount the scaffold entirely within the structure. **Up-Right Scaffolds, 1013 Pardee St., Berkeley, Calif.**

◆

Lorain MC-820 Moto-Crane

A notable advance in mobile equipment for handling heavy materials, which makes possible the lifting and transporting of loads heretofore beyond the capacity of such equipment, is signalized by announcement from Thew Shovel Co., of a giant, rubber-tired, two-engined moto-crane, said to be the world's largest. The crane has a safe-rated lifting capacity, on outriggers, of 45 tons at a 12 ft radius. The MC-820 moto-crane greatly extends the rubber-tired crane's basic advantages in heavy-duty crane service as, for example, in steel mills, steel erection, ship building, bridge building, logging, oil fields, and any other industries where the handling of heavy materials is an essential operation. Many applications are anticipated as industry gains experience with the new unit. **Thew Shovel Co., 1410 Terminal Tower, Cleveland 13, Ohio.**



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OPERATING COST

TWO outstanding features of Layne Well Water Systems are—Higher Production and Lower Operating Cost. These advantages are the result of excellence in engineering design, plus the proper methods of installation. Such features are of utmost importance in all situations where ground water is used in large quantities: cities, factories, chemical plants, railroads, packing houses, steel mills, refineries, etc.

But Layne is not satisfied to offer higher production and lower operating cost alone. There is the matter of dependable quality and substantial construction. Not once in nearly seventy years of Layne operation has quality been lowered. Today, your Layne Well Water System is better than ever before; tougher where wear is heaviest, more rugged where strength is needed and finer machined for accuracy and smoother operation.

For the best that skill and care can create, plus top flight and proved efficiency at low operation cost, insist on a Layne Well Water System.

For further information, catalogs, bulletins, etc., address Layne & Bowler, Inc., General Offices, Memphis 8, Tenn.

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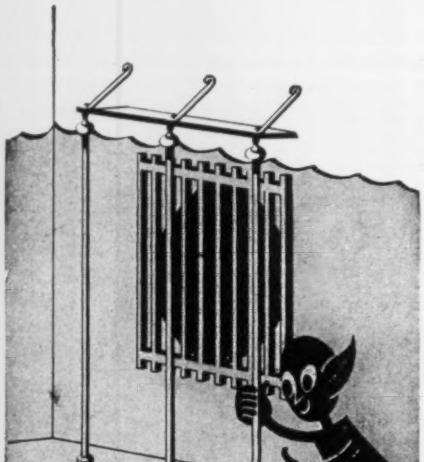
WELL WATER SYSTEMS

AFFILIATED COMPANIES: Layne-Arkansas Co., Stuttgart, Ark. ★ Layne-Atlantic Co., Norfolk, Va. ★ Layne Central Co. Memphis, Tenn. ★ Layne-Northern Co., Mishawaka, Ind. ★ Layne-Louisiana Co., Lake Charles, La. ★ Louisiana Well Co., Monroe, La. ★ Layne-New York Co., New York City ★ Layne-Northwest Co., Milwaukee, Wis. ★ Layne-Ohio Co., Columbus, Ohio ★ Layne-Pacific, Inc., Seattle, Wash. ★ Layne-Texas Co., Houston, Texas ★ Layne-Western Co., Kansas City, Mo. ★ Layne-Minnesota Co., Minneapolis, Minn. ★ Iternational Water Corporation, Pittsburgh, Pa. ★ International Water Supply, Ltd., London, Ont., Can. ★ Layne-Hispano Americana, S. A., Mexico, D. F.

STOP FISH



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This patented fish control method employs modern electronics in overcoming a serious operating and maintenance problem. Fish of all sizes are kept at a *safe distance* from intake structures, or screens, by the use of an Electronic Control Unit. This equipment, generating special electrical impulses, energizes an electrode system designed and engineered for your particular fish control problem.

The Burkey Electric Fish Screen has been thoroughly proven through years of service in Condensing Water Intakes, Hydroelectric Plants, Water Systems and Industrial Pumping Installations. DOES NOT STUN OR KILL FISH.

Recommended by State Conservation Officials.

Free literature and quotations upon request

Electric Fish Screen Co.

1130 No. Poinsettia Place
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New "Vestpocket" Ditcher

THE COMPARISON BETWEEN the "vest-pocket" battleships and the regular battleships of World War II is comparable to the difference between the new Buckeye 401 pony ditcher and the other ditchers in the Buckeye line. One of the smallest excavating machines ever built, the 401 ditcher digs ditch as narrow as 6 in. wide. Digging buckets for 8 in. are available. The unit digs to a 4 ft depth. It weighs only 6,580 lb and is powered by a 47-hp (at 1,600 rpm) industrial gasoline engine. Maximum length is only 13 ft 9 in. and width is 4 ft 4 in. Its compactness enables it to squeeze through areaways and to traverse lawns and walks without damaging them. The excavator boom is all-welded steel box type and is raised and lowered by means of self-locking worm hoist, powered directly from engine transmission. Spoil is discharged to both sides of ditch. Crawlers, driven from forward by heavy truck type differential, are non-clogging and have cast alloy steel treads. Left side crawler is adjustable vertically so that machine can maintain an "even keel" and dig a vertical ditch when operating along a slope or with one crawler on a curb. Proving ground tests and actual on-the-job tests have shown the 401 pony ditcher to be ideal for ditching for small gas mains and for service pipe from main to residence. **Gar Wood Industries, Inc., Findlay Div., Findlay, Ohio.**

◆

Leaf Collector

A NEW LEAF and litter collecting unit is now available to municipalities. The Good Roads leaf collector includes such features as a hydraulic jack under the trailer tongue for facilitating hitching, hydraulic jack under dump body for dumping load in less than 1 min, a special vacuum snout mounted on a free-wheeling tricycle undercarriage for use under and around parked cars, around sharp corners, into driveway entrances, etc., self-contained 40-hp Ford Industrial Power Unit, a suction able to pick up and powder glass bottles, stones, small branches, water-soaked leaves, etc. Hopper capacity equal to 10 or 12 truck loads of non-compacted leaves plus the ability to travel at speeds up to 60 miles per hr. **Good Roads Machinery Corp., Minerva, Ohio.**

Your Guide to Lower Door Costs

KINNEAR
ROLLING DOORS
ACTURING COMPANY

You'll want to have this data in hand when you're considering doors! The 1948 Kinnear catalog gives you complete, fully illustrated details on highly efficient, space-saving doors for every need. It tells why the many advantages of coiling upward action have made Kinnear Rolling Doors world-famous for longer service at lower cost. Includes full information on Kinnear Motor Operators—the key to easy, time-saving push-button door control. Also gives details on Kinnear's various sectional-type doors and other closures, for all types of industrial, commercial and residential installations. Write for your free copy of this complete door guide today!

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KINNEAR
ROLLING DOORS

New Loader Works in Close Areas

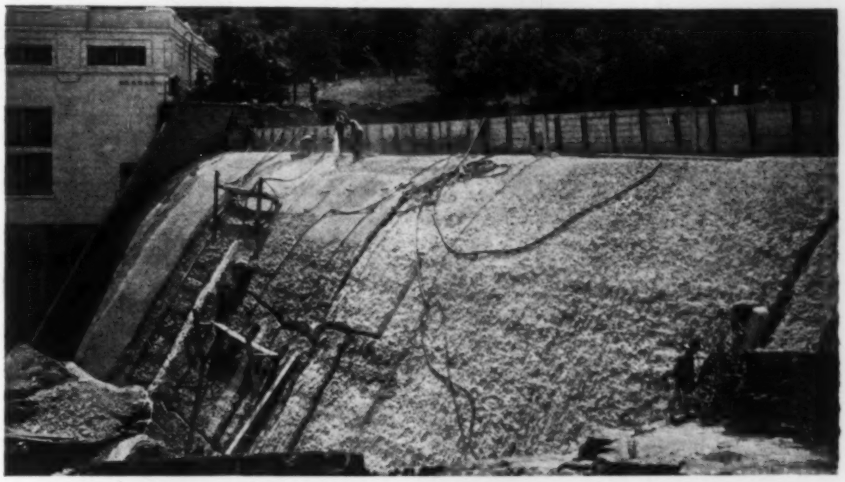
A NEW BUCKET LOADER with a shorter base dimension to improve maneuverability, and with elevator and discharge mechanisms engineered for alongside truck loading and minimum headroom requirements has just been announced by N. P. Nelson Iron Works, Inc. Employing the Nelson principle of "picking before shoveling," the new Model K5-B is equipped with renewable steel-toothed feeder blades that loosen the material and assure full loading for every bucket, every trip. Rated capacity of the loader is 2 yd per min, handling earth, sand, gravel, cinders, coal, etc. A pivoted discharge equipped with a belt conveyor loads trucks as they pass alongside. Angle of discharge is controlled from the operator's platform. Discharge conveyor can be locked in any position in its 180 deg arc of operation. Manufacturer points out that compactness (base: 11 ft 11 in.; height: 12 ft 8 in.) gives the Nelson K5-B definite operating advantages when working in crowded areas where short turning radius is essential and along road shoulders and similar places where low clearances prevail. **N. P. Nelson Iron Works, Inc., Clifton, N.J.**

◆

Literature Available

WIRE ROPE—A booklet recently released presents wire rope in a novel and interesting manner. It is a 16-page picture story entitled "The Wonders of Wire Rope." In something of a "comic book" style it tells about the travels of a power shovel operator and his family. They see the many uses of wire rope from deep in the earth to high in the sky, see how wire rope is made, and hear the story of Preformed wire rope. **Preformed Wire Rope Information Bureau, 520 N. Michigan Ave., Chicago, Ill.**

MIXERS ON THE MOVE—New literature describing FWD trucks available for mounting ready-mixed concrete bodies has been announced. Entitled "Mixers on the Move," the folder describes use of the trucks in capacities ranging from 20,000 to 38,000 lb gross vehicle weight for use with mixers from 2 to $5^1/_2$ yd capacity. **The Four Wheel Drive Auto Co., Clintonville, Wis.**



DAM REPAIRED WITH "GUNITE"

The photograph shows the "GUNITE" restoration work in progress on the downstream face of a badly disintegrated concrete dam belonging to the Central Hudson Gas and Electric Company near Poughkeepsie, New York.

Note the freshly chipped portion in the foreground, the "GUNITE" being applied and the completed "GUNITE" work in the background. Drainage channels were provided behind the "GUNITE" to lead seepage to the toe and thus prevent frost damage to the new "GUNITE" coating. We did this work in 1942.

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CEMENT GUN COMPANY
"GUNITE" CONTRACTORS
GENERAL OFFICES—ALLENTOWN, PENNA., U.S.A.

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The latest development in the art of foundation construction, the Drilled-In Caisson can be installed through any overburden into rock.

Individual 24" Caissons carry 1,060 tons
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MH

HYDRANTS & VALVES

Pipe Line Accessories for Water Works and Sewage Works

Write for Catalog No. 34

VALVES: A.W.W.A. type iron body, bronze mounted with double-disc parallel seat or solid wedge type. Non-rising stem, outside screw and yoke, or with sliding stem and lever. Also furnished hydraulically operated. Square bottom type operates in any position.

HYDRANTS: Standard A.W.W.A. type approved by Underwriters and Factory Mutuals.

M & H PRODUCTS INCLUDE

- FIRE HYDRANTS
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- TAPPING VALVES
- WALL CASTINGS
- SPECIAL CASTINGS
- TAPPING SLEEVES
- CHECK VALVES
- FLOOR STANDS
- EXTENSION STEMS
- SHEAR GATES
- MUD VALVES
- VALVE BOXES
- FLAP VALVES
- SLUDGE SHOES
- FLANGE AND FLARE FITTINGS
- FLANGED FITTINGS
- B & S FITTINGS
- CUTTING-IN TEES

M&H VALVE
AND FITTINGS COMPANY
ANNISTON, ALABAMA

Literature Available (Cont.)

What to do About Mercury Vapor—Information Circular No. 2 tells where to look for danger from mercury vapor, how chronic mercury vapor poisoning occurs, and how to measure its concentration. The Randall process of mercury vapor control offers information on how to keep the mercury vapor concentrations below the toxic limit by answering vital questions. **Randall and Sons, 2512 Etna St., Berkeley 2, Calif.**

Concrete Dumper—A new illustrated pamphlet, No. L-102, showing the wide use of the Dumpcrete body by contractors for hauling concrete without agitation is announced. Action pictures show the Dumpcrete in use on highway, bridge, power plant, public works and industrial projects. The pamphlet describes why Dumpcrete-hauled concrete is better and can be delivered faster at less cost. **Maxon Construction Co., Dumpcrete Div., 131 N. Ludlow St., Dayton 2, Ohio.**

Carryable Generators—A new 12-page bulletin, L-408, describes Homelite Corporation's complete line of carryable gasoline-engine-driven generators. This bulletin shows, in words and pictures, the many uses for carryable electric power. It shows how you can save money on your jobs by using time-saving electric tools. A check list of qualities to look for in a generator is included in the bulletin, to guide you in selecting a unit to meet all of your requirements. **Homelite Corp., 2408 Riverdale Ave., Port Chester, N.Y.**

Application of the Pulvi-Mixer—Bulletin No. 30 outlines the improvement of highway shoulders. It deals concisely with widely extended problems now attending our overcrowded highways. The application of the pulvi-mixer in the construction of the various types is emphasized by both text and illustrations. Accompanying this booklet is Bulletin No. 50 which offers a non-technical discussion on the processing of soil-cement with the pulvi-mixer. The text describes the mixing action of the machine, its several recent improvements and its adaption and application to soil-cement construction. **Seaman Motors, Inc., 305 N. 25 St., Milwaukee, Wis.**

Soil Stabilizer—Publication of a new 2-color bulletin, No. S6-1, describing the P&H single-pass soil stabilizer is announced by the Harnischfeger Corporation. The booklet illustrates the various features and operations of the stabilizer along with pictures showing this machine on-the-job processing both soil-cement and soil-bituminous roads, streets and airports. A section of the new bulletin is devoted to photographs and drawings which show clearly how this one machine with one operator in a single pass performs the five distinct operations of soil-cement and soil-bituminous stabilization. **Harnischfeger Corp., 4400 W. National Ave., Milwaukee 14, Wis.**

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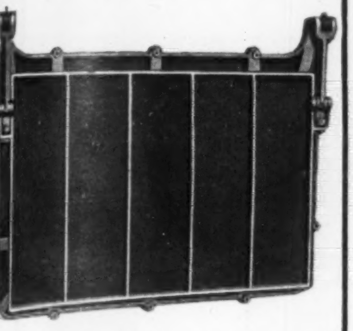

Fig. B-61. Type M-M

Type M-M (Rectangular) Tide Gates are available in 37 sizes from 8″ x 8″ to 96″ x 96″. Bulletin No. 71 describes them fully.

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Literature Available (Cont.)

WATER CONDITIONING—"Zeo - Karb Water Softeners and Dealkalizers" and "Spaulding Precipitator" are the titles of two new bulletins recently released. Both booklets contain valuable information which is accompanied by diagrams, charts and specifications of much use to the reader. **The Permutit Co., 330 W. 42nd St., New York 18, N.Y.**

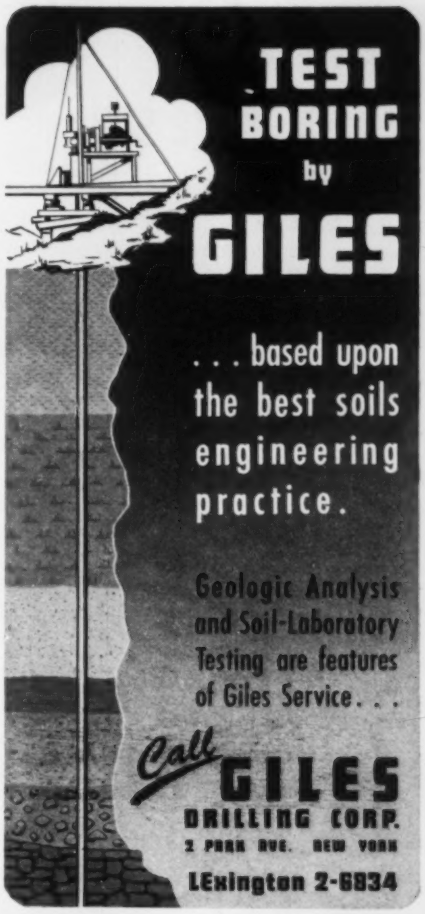
WATER MEASURING EQUIPMENT—A 20-page, 2-color booklet (Bulletin 310) gives complete descriptions of the various types of water measuring equipment. Diagrams of meters, station equipment, striptograph recorders and controls are included with charts and a price list. **R. W. Sparling, Terminal Annex, Box 3277, Los Angeles, Calif.**

PAVERS—Catalog No. 48-18 just published by Chain Belt Company describes the modern Rex 34E single and double drum pavers which are different from the ground up—inside and out. The catalog illustrates the major features of these modern Rex pavers in detail. Rex hydrocycle (automatic) control is explained as to what it is, what it does, and why it increases production. Complete specifications and dimensions are included. **Chain Belt Co., 1600 W. Bruce St., Milwaukee 4, Wis.**

EQUIPMENT FOR CONSTRUCTION—Of interest to all construction men is Catalog No. JC-8 covering details on "Air Plus Compressors," Catalog No. TM-8 covering "Hi-Dump Truck Mixer" and Catalog No. M-8 covering "Trailer Mixers." All booklets contain complete descriptions and are picturesquely illustrated. Detailed specifications and tables are also found in this attractive and worth-while offer. **Jaeger Machine Co., Columbus 16, Ohio.**

SLING CHAINS—"Sterling Wrought Iron Sling Chains" (Bulletin SC-48), is the title of a recently published booklet containing information on safety rules, chain inspection, use and care. Recommended load limits are listed in detail for various chain sizes and suspension angles. Single and double sling chain specifications are presented in tabular form. **Cleveland Chain & Mfg. Co., Cleveland 5, Ohio.**

CONSTRUCTION PUMPS—A series of self-priming centrifugal pumps and diaphragm-pumps especially designed for use in construction work are described in a 12-page, 2-color bulletin, No. C-48, just released by Marlow Pumps. The Marlow Water Wizard pump, for contractors is an exceptionally fast primer (35 sec at 15 ft lift) and, is guaranteed to prime automatically on suction lifts to 25 ft. Specifications are given for the Marlow Mud Hog diaphragm pumps together with features that enable these rugged pumps to handle thick and trash-laden liquids easily. **Marlow Pumps, 537 Greenwood Ave., Ridgewood, N.J.**



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Literature Available (Cont.)

BRICK ENGINEERED HOMES—A ne plan book contains floor plans and elevations for six newly designed homes o masonry construction, to be built alon the most modern and economical engineering principles. This plan book i said to represent the first group of engineered homes anywhere for which actual working drawings are available The cost of the planbook is twenty-fiv cents. **Structural Clay Products Institute, 1756 K St. N.W., Washington, D.C**

JOINT-SEALING COMPOUND—A new 6-page folder on "Flintseal" hot-poured joint sealing compound for concrete pavements has just been issued. The folder gives a description of this thermoplastic rubber asphalt sealer and shows examples of equipment being used for its application. Diagrams are given showing the correct preparation of the joint and Flintseal, the proper method of application and the results of the compound's use. **The Flintkote Co., Inc., 30 Rockefeller Plaza, New York 20, N.Y.**

D6 TRACTOR BOOKLET—"The 'Caterpillar' Diesel D6 Tractor" is the title of a 2-color, 32-page booklet recently released. This publication, also known as Form 10980, presents the specifications of the "Caterpillar" D6 track-type tractor along with manufacturing and engineering features. Highlighted in this booklet are typical jobs that are handled quickly and economically by the D6 tractor regardless of mud, dust, heat or cold. Its massive frame and rugged power train fit the toughest jobs. **Caterpillar Tractor Co., Peoria 8, Ill.**

INDUSTRIAL WATER TREATMENT—A new booklet describing industrial water treatment problems and modern methods of solving them is now available. The booklet, of particular interest to plant engineers, plant managers and executives, is attractively printed in 2 colors and generously illustrated with pertinent photos and charts. The text covers the broad subject of industrial water treatment from simple, basic theory for the layman to specific problems involved in the use of water for power, process and cooling. The complete Bird-Archer 8-point Treatment System is described in full detail. **The Bird Archer Co., 400 Madison Ave., New York 17, N.Y.**

PORTABLE MATERIAL ELEVATOR—In a new 8-page Catalog, No. 200-D-6A, covering their portable material elevator, American Hoist announces a new allowable height of 97 ft, with a platform lift of 90 ft. The elevator is self-erecting when used at the 47 ft height or under. A concrete bucket of 14 cu ft capacity is available which is interchangeable with the 6 × 6 ft platform, both units being pin connected for quick, easy installation. The booklet contains many operating views and mechanical details. **American Hoist & Derrick Co., Advertising Dept., 63 S. Robert St., St. Paul 1, Minn.**